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The "Viceroy of India."

THE official trials of the T.S.S. *Viceroy of India* which took place on the River Clyde the other day in the presence of a distinguished gathering of shipowners, shipbuilders, and engineers, may truly be said to mark an epoch in the history of electrical engineering in this country. She is not, of course, the first electrically-propelled ship to be built in this country; indeed, as we showed in a recent article, Great Britain can rightly claim to be the cradle of the idea of applying electricity to the propulsion of ships, but she is the first large passenger liner built in this country in which electric propulsion has been adopted, and as such not only was her performance watched with the greatest interest, but her future career will also be carefully followed by all who are convinced of the merits of electricity for marine propulsion.

The *Viceroy of India* is a P. & O. vessel 612 ft. long of about 19,700 gross tons which has been built at Linthouse, Glasgow, the propelling machinery consisting of two 9,000-kW turbo-alternators which supply power to two three-phase synchronous motors, each capable of developing 8,500 shaft-horse-power at a maximum speed of 109 revolutions per minute, one of the motors being directly coupled to each of the two propeller shafts. Steam is obtained from six oil-fired boilers at a working pressure of 350 lb. per sq. in., the steam being superheated to a final temperature of 700 deg. F. The whole of this equipment was supplied by British companies.

Although one of the great advantages which is usually claimed for electric propulsion is that it enables the large amount of electricity required in an up-to-date liner for operating the auxiliary machinery, cooking, lighting, &c., to be obtained from the large main generators, rather than from smaller auxiliary generators, thereby obtaining a higher overall efficiency, it has been deemed advisable on the *Viceroy of India* to install separate direct-current generators for auxiliary purposes. There are four turbo-generators each of 500-kW capacity for dealing with the auxiliary load when at sea, while for use in port, particularly when the boiler plant may be shut down, there are two Diesel-engine-driven sets, each of 165 kW capacity. A feature of the auxiliary equipment is the adoption of the

Austin constant-current system for the motors which are used for driving the cargo winches, the windlass, the refrigerating machinery, &c. It may also be noted that while the majority of the pumps in the engine room are electrically driven, the boiler feed-water pumps are of the steam turbo-driven type, and the Weir closed-feed system with three stages of feed-water heating is used.

The chief advantage of electric propulsion as applied to a mail and passenger liner, which must keep more or less to a scheduled time-table, lies in the fact that she can run at a cruising speed with the same efficiency as at full speed. Thus, in the *Viceroy of India*, with only one alternator in service, the power delivered to the motors aggregates 11,600 s.h.p., which is capable of giving the vessel a speed of 16½ knots; but at the designed full speed of 19 knots both alternators are brought into service, the full power of the motors, totalling 17,000 s.h.p., being delivered to the propellers. Arrangements have naturally been made for economical operation of the boilers according to whether one or two alternators are running, since the P. & O. service between London and India, picking up mails at Marseilles, is such that running sometimes at cruising speed and sometimes at full speed is demanded. This feature of the equipment was stressed by Mr. A. E. Stephen, the chairman of Alexander Stephen & Sons, the builders, at the luncheon on board the vessel during the course of the trials, it having been found that with one turbo-alternator in use, a speed of 17.1 knots was realised, the propelling motors delivering 10,410 s.h.p. at 97 r.p.m. Unfortunately, owing to fog, it was impossible to run full-speed trials, and for the same reason fuel-consumption figures are not yet available.

While, however, optimism was expressed about the results achieved, those responsible for the ship make no secret of the fact that they will expect any subsequent vessel to do even better. Thus, Mr. A. S. MacLellan, a director of the builder's firm, in paying tribute to the B.T.H., Yarrow and Weir companies, which were mainly responsible for the machinery, mentioned that they had learned a great deal during her construction, and he felt sure that if the installation were repeated they could make many improvements in simplifying the control gear, in the general arrangement, in reducing cost, and in increasing the overall efficiency. He had been in the United States investigating the electric drive and had been amazed by what he had seen; but about one thing he had no doubt, he believed that the electric motor was the ideal drive for marine propulsion. We echo Mr. MacLellan's faith and pay tribute to his belief that subsequent vessels will show a marked improvement on the new P. & O. liner, satisfactory as that vessel undoubtedly is. This is the spirit of enthusiasm for which the Prince of Wales called in his recent B.I.F. speech on "Salesmanship" and the spirit which will convince shipowners of the merits of the electrically-driven ship. We sincerely hope that some of the shipowners who were present at the trials of the *Viceroy of India* may be persuaded to adopt this system of propulsion on any new ships which they may be ordering, so that the builders and the engineers may speedily have an opportunity of justifying their faith in future vessels.

The New Year Honours.

WE are sure that there will be general satisfaction amongst our readers with the inclusion of two well-known electrical men in the King's New Year Honours List. We offer the profession's congratulations to Dr. John Ambrose Fleming, M.A., F.R.S., Emeritus Professor of Electrical Engineering at University College, inventor of the thermionic valve and a scientist of great distinction at home and abroad, who receives the honour of knighthood. An account of his career appeared in the ELECTRICAL REVIEW for February 24th, 1922, when he delivered a lecture on "Michael Faraday and the Foundations of Electrical Engineering" in connection with the Jubilee Celebrations of the Institution of Electrical Engineers. Congratulations will also be freely given to Col. Thomas Fortune Purves, O.B.E., M.I.E.E., engineer-in-chief of the General Post Office, and a vice-president of the Institution of Electrical Engineers, upon his knighthood. Col. Purves, it will be remembered, succeeded Sir William Noble as engineer-in-chief of the Post Office in 1922. A record of the important work that has been accomplished in the past seven years appears on our "Personal" page to-day. His Majesty's Trade Commissioner in New Zealand, Mr. L. B. G. S. Beale, is made a C.B.E. (Civil Division), and the additions to O.B.E.'s (Civil Division) include Major J. A. Sadd, B.Sc., A.C.G.I., A.M.I.E.E., Superintendent of the Defensive Munitions Department, Porton, and Mr. P. A. Theis, assistant secretary to the Pacific Cable Board. Mr. J. A. B. Jones, assistant electrical engineer to the Sudan Government Railways, is made an M.B.E. (Civil Division), and Mr. E. E. Gunter, director of the Persian Gulf Telegraphs, Indo-European Telegraph Department (retired), receive the honour of Companion of the Order of the Indian Empire.

We may be permitted to indulge in the not unusual discontent with the small measure of recognition that is given to men of electrical distinction.

Electrical Publicity by Wireless.

MOST of our readers, doubtless, switch in occasionally, without the broadcasting programme in hand, just to find out what is on. The result is sometimes distinctly interesting and it suggests that very few people are qualified to pass wholesale strictures on the service given unless they listen all the time. For example, quite by accident during the past month or six weeks we have switched in just in time to be unexpectedly impressed by some electrical point. On one occasion a lady speaker was holding forth in admirable manner regarding different ways of cooking, and the splendid testimonial that she was giving to electric cooking, wherever energy can be obtained at a low charge per kWh, formed a most valuable piece of publicity matter reaching the ears of thousands of ladies who make a practice of listening to household matters. The second electrical occasion that we have in mind was the talk by Dr. T. Z. Koo on "China To-day" on a recent Wednesday evening, in which the new situation that is developing in China was described. We cut in just as the speaker was saying: "China is waiting for electrification!" "China is waiting for machinery!" We have long dwelt upon the great field that mechanical and electrical engineering must have in the China that makes economic progress based upon stability, and as the authority of the broadcaster seemed to give weight to his remarks, we pass them on to the British electrical manufacturer, engineer, financier and trader. If we are thinking more of Russia now, let us not regard China as an impossibility. Let us act in time, with big ideas, efficient organisation, and big financial backing.

Copper.

THE prolonged rise in the price of copper which carried the price of cash standard from £60 15s. to £74 12s. 6d. and of electro from £66 15s. to £74 5s. last year, which figures have been exceeded enormously during the past couple of months, has been little short of remarkable. Certainly it went far beyond the anticipations of the market generally, even of the big producers themselves, whose plans had long been laid to put the metal upon a permanently and substantially better basis of price. Even to-day, and after the big advance established to a level almost exceeding the dreams of avarice, there is a pretty general feeling that the force of the upward movement has not yet spent itself entirely, and that a further rise may occur, under the control exercised by the powerful group of producers co-operating under the title of the Copper Exporters, Incorporated. We doubt whether the present price is really justified, but to-day this group and its ramifications rule the market for the metal. Control, it is asserted, has come to stay. Dominating as they do the great bulk of the world's output, having at their fingers' ends all the most inti-

mate details of consumption and of prospective demands, the Associated Producers can, temporarily at all events, regulate and adjust supplies and demand to the nicest degree of equilibrium, and nothing is less likely than that they will abandon voluntarily their commanding position. Greed may be their undoing ultimately, as it has been in other cases, while there is, of course, the bare possibility of Governmental investigation of the copper situation by the United States. The Associated group had to exercise considerable ingenuity to steer clear of the law in America affecting trade combines, and would scarcely welcome any probing of their ramifications, or examination of their policy. They will, therefore, endeavour, no doubt, to entrench themselves without stirring up active trade hostility, which might result in official interference. Whatever may be the case in Europe, the consumption of copper in America this year promises to beat all records, especially in the matter of wire, thanks to the big programmes of railway electrification, telephone and telegraph extensions, &c. The public utility companies in America, for example, contemplate an expenditure this year of over $850 millions, a record total. Prices to-day are hugely profitable and prudence would suggest that the pace be not forced too much lest consumption suffer. Any signs of pressure of re-sale copper from over-bought consumers would give the market a nasty jar. That a long-ahead view is being taken by American copper interests is shown by the very close attention certain of these are paying to the possibilities of African copper being, in years to come, an active competitor with American. Hence the recent boom in Rhodesian copper properties, which forced the shares of many concerns to a very high premium under the stimulus of persistent American buying. Bwana M'Kubwa is a case in point, but there are also others in which American capital is interested. It is to be hoped that British copper producers, actual and potential, in Africa, will not fall under the control of United States capital. Working arrangements as between rival producers may be all very well, but it would be a misfortune if foreign financial control were obtained of the Rhodesian mines.

The Kennedy Memorial.

Invariably inapposite in her gifts, Nature denies to the many the comfortable quiescence they covet and urges others to activities in which few are fitted to partake. One of the most difficult of the problems confronting the engineering industry to-day being the recruitment of men of character, intellect, and initiative, it is appropriate that attention should be directed to the projected endowment of that department of University College, London, over which the late Sir Alexander W. B. Kennedy, LL.D., D.Eng., F.R.S., M.Inst.C.E., M.I.E.E., M.I.Mech.E., long presided with such distinction.

That there should be a permanent and lasting memorial of the affection and esteem with which he was regarded is a feeling common to all who knew him and his work; and what more fitting one than the endowment of the chair to which he consented to give his name? He was a pioneer in engineering education, and as an engineering practitioner his wide mechanical and electrical knowledge was always available for the service of his country.

Of the total sum of £30,000 needed, £11,965 still remains to be subscribed. The project must command the sympathy of all who benefited by Kennedy's great work, no less than that of all who knew him personally. Donations are invited to be sent to the Right Hon. Lord Meston, chairman of the University College Centenary Fund, at University College, Gower Street, London, W.C.1.

A Debtless Undertaking.

An electricity undertaking that is entirely free of debt is probably unique in electricity supply finance. This position has been reached by the Hampstead Borough Council which intends to clear off the balance of its indebtedness (£32,310) at the close of the financial year. The total amount borrowed at March 31st, 1928, was £530,627, about half a million of which had been redeemed.

There are, of course, special circumstances in this case. Hampstead ceased to generate electricity in 1922 and a bulk supply has been taken from St. Marylebone since 1921. Thus when the Council had written off the cost of its generating plant, it only had to deal with the far cheaper sub-station machinery, but it has to be remembered that the capital cost of the distribution system has also been written off.

It is obvious that any undertaking could free itself from debt by charging high prices (if it could sustain the necessary demand), but the Hampstead charges are among the lowest in the country. In earlier years they were not so favourable to the consumer, but they could not be considered excessive for a residential district.

We congratulate the Hampstead Council and its engineer (Mr. J. Leadbeater) on achieving this enviable position.

The Faraday Lecture.

That the greatest and most successful industries and manufacturing concerns are those which spend most money on research is a lesson plain for all to learn, if they will. A feature of our age, however, is the vast range of scientific research, the extraordinary number of capable workers in that field, and the enormous accumulation of data that is being made available. Few of us indeed can ever hope to acquire more than a mere fraction of the sum of knowledge extant even in our own particular sphere, consequently the vast majority of professional men, and women too, work within a very limited range.

Thus it was that the annual Faraday Lecture, delivered in London, and at most of the provincial Local Centres too, to large meetings of the Institution of Electrical Engineers this Session, by Mr. Ll. B. Atkinson in his own inimitable manner was greatly appreciated, for he told us "How Electricity does Things."

As the proposer and seconder of a vote of thanks to him remarked, we listened to a scientist, an engineer, and a teacher: how simple it all seems when explained happily! We now know what electricity is, or think we know, for it appears that "electricity is everything." Electrons are all-important, they constitute matter itself, variety being a consequence of their relative movement, or vibration, shall we say. Indeed, it seems that we know more about electrons than we do of matter itself.

In order to fit himself for the adequate control of the vast forces of nature for the benefit of his fellow being, every engineer must endeavour to obtain as comprehensive a view as is possible of the range of contemporary research, in his own section of the profession at least, so as to enable him to visualise the possible practical applications of new discoveries.

Central Board Contracts.

It was very appropriate at the conclusion of the British Industries Fair on Friday last that Sir Andrew Duncan should have announced the near approach of another big stimulus to British industry, in the shape of contracts to the value of £3,000,000.

We were informed that details would not be available until the end of the current week, but it can be said that the contracts are in connection with the South-East England Scheme (London Area) and the Central and North-West England Schemes.

There is no doubt that the electrical manufacturing industry has reason to be grateful to the Board for the way in which it is speeding up its work. Already contracts to the value of £3,000,000 have been placed; we gave a list including the bulk of them in our issue of November 16th last (p. 846). They and the orders being given out this week should have a marked effect upon the British electrical manufacturing industry, and it is to be hoped that the supply industry, and eventually the public, will in time reap further benefits.

A Large Turbo-Electric Liner.

An account of the first large passenger ship to utilise high-pressure steam and be fitted with turbo-electric propulsion equipment on the British side of the Atlantic Ocean.

MESSRS. ALEXANDER STEPHEN & SONS, LTD., Linthouse, Glasgow, have completed the turbo-electric ship *Viceroy of India*, built for the Peninsular and Orient Steam Navigation Co. The liner is a vessel of 19,700 tons gross with a length of 612 ft., a breadth of 78 ft., and a depth (from the highest of the nine decks) of 82 ft.

On February 19th our representative, as a guest of the builders, took part in a trial trip and visit of inspection. The liner had been weatherbound by fog for several days and so hindered from completing her speed trials, but the morning sun made a very impressive picture of the new all-electric ship lying off Gourock with her bows to the open seas, the snow-covered mountains of the Firth of Clyde forming a striking background to the black hull and twin funnels.

The lines of the vessel are very pleasing, and the straight stem and rounded battleship stern gave the expectant passenger the impression of power and security. Her lofty lee side afforded the visitors on the approaching tender a welcome shield from the unnaturally cold south-east wind, but when we had climbed the gangway and entered the magnificently panelled and carpeted reception rooms all the outside wintry weather was forgotten. Every modern comfort and luxury which ingenuity and good taste suggest seems to have been expended on the fittings and furnishings of the public rooms. The scheme of decorations was carried out by Waring & Gillow, Ltd.

Skilful use has been made of cornice and panel lighting, and delicate colour tones have been introduced by means of illuminated cut and moulded glass. From the great dining-room French windows one seems to look out on a land bathed in afternoon sunlight, and the rich yellow glow from the casements is cheerfully reflected from the mirrors and cut-glass fitments of the pillars and ceiling.

The ventilation throughout is on the "Thermotank" principle, and where and when required silent ceiling pattern electric fans disperse gentle breezes. Local heat is provided mostly by Igranic panels protected by neat metal guards.

The wiring and the fitting of appliances for lighting, cooking, washing, and the like, were carried out by the builders' engineers. The kitchens contain illuminated electric dish washers, electric choppers, coffee grinders, roasters, and so on. Ovens and hotplates abound, and all the multitudinous electric devices which save labour and ensure satisfaction in the art of cookery.

The general illumination of the decks has been well considered, the watertight brackets being of the prismatic type supplemented with ceiling fittings shielded by metal guards to prevent undesired lighting of the deck-cabin windows. The play rooms and large ornamental swimming pond are appropriately and evenly illuminated. Over 6,000 "Mazda" lamps are used for the lighting installation of the liner.

Very complete telephone communication is provided throughout. The ship's indicators are of Siemens make, while the bells are of the "Tangent" pattern.

Proceeding to the open upper deck by an attractively upholstered electric passenger elevator, we were surprised to note how far we were from our starting place and that landmarks were being rapidly left behind, for there had been no perceptible movement in starting and the slightest symptom of vibration was absent. As the ship glided silently and electrically through the water our thoughts went back to the pioneer work of the late Mr. Henry A. Mavor, M.I.E.E., whose dreams of electric drive have been realised too tardily in this country. All must appreciate now that the electric motor is the ideal medium for marine propulsion.

Advantages of the Electric Drive.—Among its advantages there is the absence of noise, as compared with a geared turbine; the elimination of the astern turbine; the absence of propeller racing in heavy seas; and the use of fewer and smaller steam pipes, which helps considerably to keep the passenger accommodation cool. The absence of vibration, due to the fact that the whole of the machinery is of the rotary type, will also prove a great benefit to passengers and to the structure of the ship. Among the more positive advantages are the command of full power when going astern, low maintenance charges, particularly with regard to consumption of stores and overhauling (at reduced power a single turbine is used in place of four, or six, in the case of geared machinery), and the benefit of being able continuously to obtain accurate data about the power absorbed in propulsion.

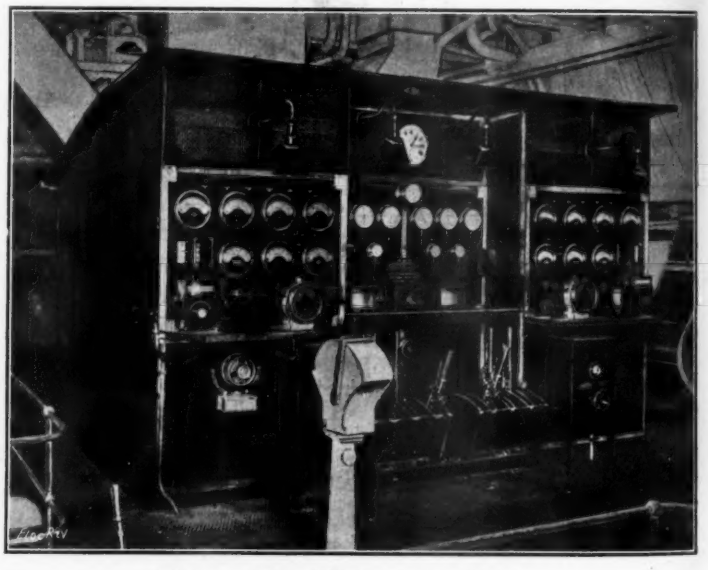


Fig. 1.—Main Ship's Control Board.

Electricity in Navigation.—It would seem that the possibilities of electricity on board this ship are endless. The navigating officers communicate with the power room by Siemens ship's telegraphs and telephones; from the bridge they can note by a glance at the electrically-illuminated signs which of the anchors are cast and the length of the outpaid chain.

The chart room contains a Siemens wireless direction finder which, by the simple rotation of a handwheel, takes the bearings to within half a degree of any transmitting station within 500 miles; it has a wave-length range of from 350 to 1,600 metres. This room also

contains an echo sounding receiver made by H. Hughes and Sons, of London. The wireless room equipment is of Siemens make and much of it has been built to the specification of Mr. Alex. Shaw, deputy chairman of the P. & O. Co. The short-wave transmitter has been developed from the famous set on the s.s. *Corinthian* (which holds the world's record for short-wave work) has a world-wide range and the main transmitter has an effective range of from 3,000 to 4,000 miles. Both sets of equipment are arranged for c.w. or i.c.w. work and are operated from the 230-V mains. An emergency spark transmitter with a range of 1,000 miles has its own separate aerial and is worked from a battery, while the ship's motor lifeboat has also a wireless transmitting and receiving installation with an output range of about 150 miles and is operated by a nickel-iron battery.

The Propelling Machinery.—Leaving the attractive broad and open upper decks and descending to the main power room, we came to what is a triumph of modern engineering architecture. Entering from an alleyway one finds oneself on an iron bridge at the after end of a spacious and lofty hall. High above are the open skylights, and forward and beneath are the pair of turbo-generators with the starting platform and control cubicle set between them, figs. 1 and 2. Immediately below the bridge on which we stood and at a somewhat lower level than the generators are the two main driving motors, fig. 4. They are coupled directly to the twin propeller shafts, and one only of them is sufficient to drive the ship at three-quarter speed, which permits of great economy when cruising short distances between ports.

Each of the main turbo-alternators develops 9,000 kW at 2,690 r.p.m., the turbines being of the Curtis horizontal type, each having a Weir regenerative underslung condenser, fig. 3; B.T.H. 20-h.p. 1,000/1,600-r.p.m. 220-V vertical-spindle motors drive the extraction pumps. The alternators are air cooled, the air being forced in a closed circuit through the stator and rotor, thence through a cooler situated immediately below the alternator frame.

The main propelling motors are of the synchronous 3-phase type, at the aft end of the engine room, and develop 17,000 shaft-horse-power at 109 r.p.m. Like the alternators, the motors are air cooled, the air being forced through the windings and through a cooler in a closed circuit by two independent motor-driven fans, each of which has sufficient capacity for the full duty. Reversal of the propellers is obtained by changing the electrical connections by means of contactors, which are mechanically interlocked, so that the operator can only close them in the correct sequence. Thus the turbines run continuously in one direction when manœuvring, and the total turbine capacity is available for steaming astern. When the vessel is steaming full speed ahead at 18 knots, it will be possible to reverse the propellers and turn in the astern direction in 30 seconds from the order to reverse.

Electrical Control of the Propelling Machinery.—The main propelling equipment may be classified in three sections as follows:—

(*a*) Two turbo-alternator sets, maximum rating 9,000 kW, 2,690 r.p.m., 2,720 V, 3-phase (maximum speed rating 6,536 kW, 3,110 r.p.m., 3,150 V, 3-phase).

(*b*) Two synchronous propulsion motors, each of 8,500 shaft h.p., 109 r.p.m., 3,150 V, 3-phase.

(*c*) One control apparatus group, and also the necessary exciter sets and ventilating fans.

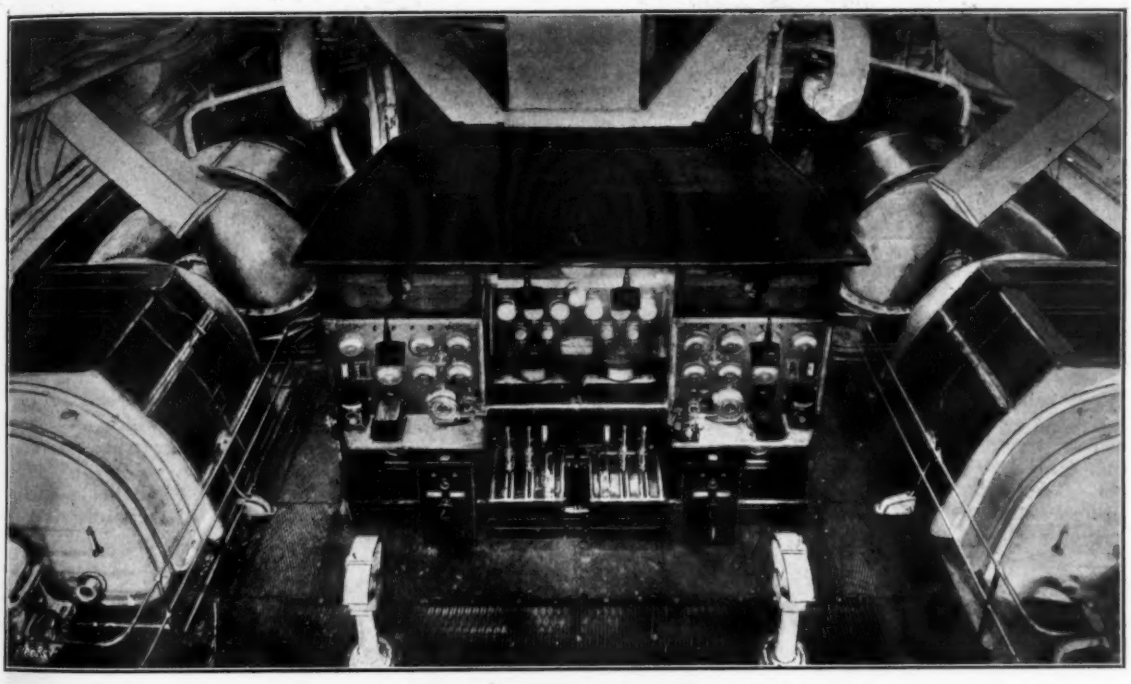


Fig. 2.—Main Turbo-Alternator Sets and Control Board.

At the forward end of the control cubicle, fig. 1, are the isolators and tie switch, each being triple pole, and operated by a handwheel. The isolators enable each alternator to be electrically connected to its respective propeller motor, or either of the alternators to be connected to both propeller motors. The controls are interlocked so that damage cannot be carelessly done to any portion of the equipment when manœuvring; at the same time, indicating instruments are provided by means of which the engineer can carry out orders in a very short time with a minimum of manual effort.

For each propeller three controlling levers are provided for operating contactors and setting the speed of the governor:—(*a*) a direction lever, (*b*) a field-and speed-controlling lever, and (*c*) a dead-slow speed lever. They are all mechanically interlocked to ensure correct working: thus, the direction lever (*a*) can only be moved if the manœuvring lever is at "stop." The field level (*b*) during its first portion of travel operates field contactors in the correct sequence for starting the motor; for the remaining part of its travel the control is on the governor of the turbine, the speed setting of which it varies between one-fifth and full speed. A

micrometer adjustment is also provided on this lever and permits fine speed settings. Since the same lever is used for both purposes, all manœuvring must take place with the governor setting at one-fifth speed. This lever is interlocked with the low-speed lever (*c*), so that the latter cannot be used for reducing speed below one-fifth, unless (*b*) is in its lowest-speed position and, correspondingly, lever (*c*) must be at its maximum-speed position before the speed can be increased by lever (*b*).

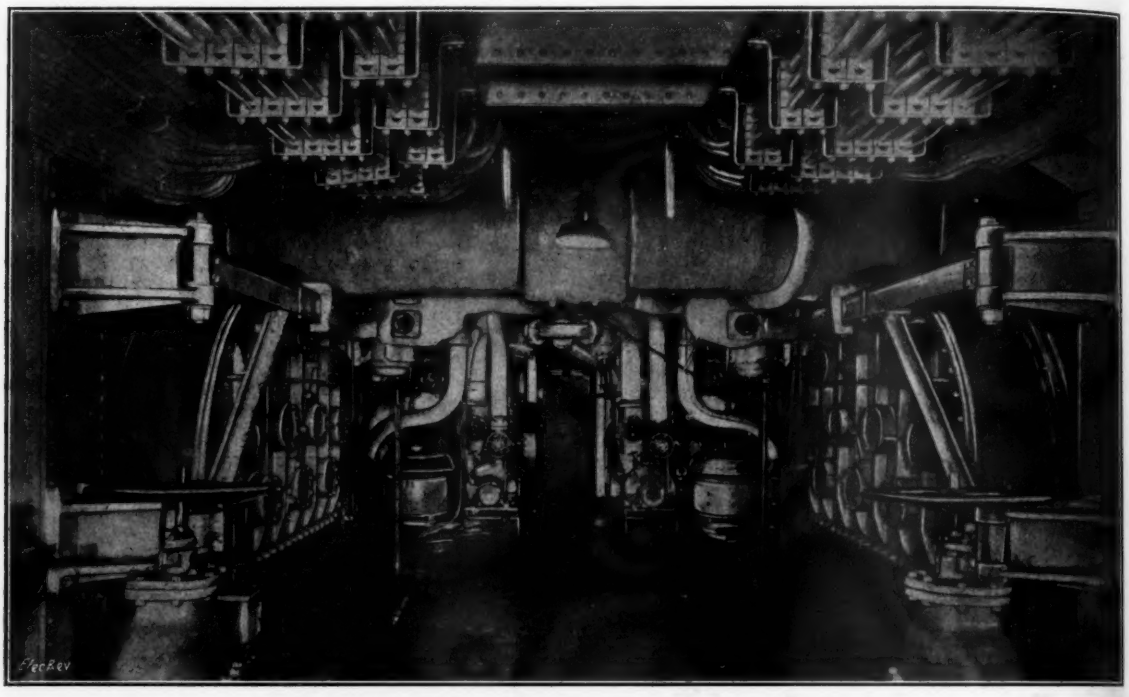


Fig. 3.—Main Turbine Condensers, note Method of Under-slinging.

The whole of the control cubicle is "mistake-proof," and special keys make incorrect switching impossible; for example, whenever it is necessary to open, or close, an isolator, or tie switch, it is essential for all contactors to be in the open position. A special lock is therefore fitted to the levers, the key of which is also used to free the isolators; the reversing and field levers must be "off" and locked in that position to release this key. An electrical interlock prevents the circuit breaker on the main d.c. switchboard from closing, unless the field levers are both in the "stop" position. This prevents the fields being switched on to the machines after a shutdown on the d.c. side without bringing the field levers to the "stop" position and starting up again in the usual way.

Immediately aft of the main propelling motors are the thrust bearings, of the single-collar Michell type, and fitted with a hydraulic device for measuring the total thrust on the propellers.

The whole of the main propelling machinery, including both turbo-alternators and motors, has been manufactured by the British Thomson-Houston Co., Ltd.

Oil-fired Boilers.—Steam is supplied at 350 lb. per sq. in. pressure and 700 deg. F. temperature by six Yarrow boilers situated in two separate stokeholds; four of them are placed in the aft stokehold and are of sufficient capacity to enable the forward stokehold to be entirely closed down when the vessel is steaming at 16½ knots. In addition, there are also two Scotch marine-type cylindrical boilers in the forward stokehold for supplying steam when the ship is in port, if needed. Two Diesel-engine generators are installed for harbour purposes.

The air required for forced draught is supplied by six electrically-driven fans; the motors are of the Austin constant-current type, providing a large speed variation by means of ingenious potentiometer controllers designed by Gilbert Austin, which operate at considerable distances, with only three cables between the control switch and the fan motor.

The boilers are arranged for oil-fuel firing on the "Clyde" system, manufactured by the builders.

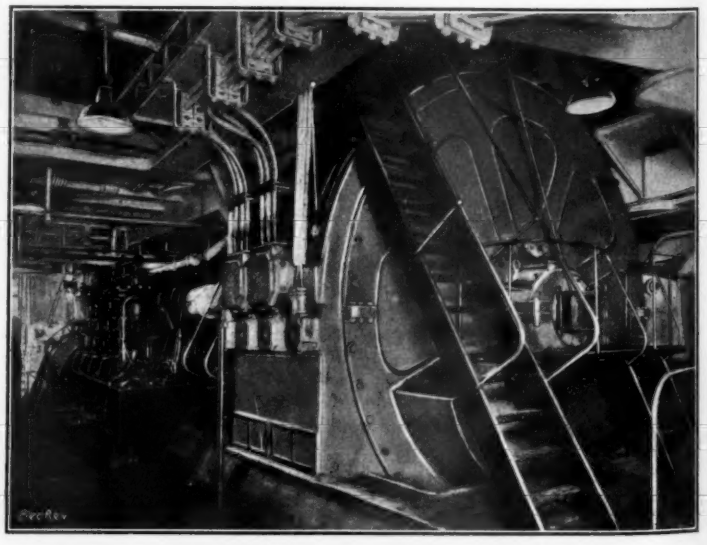


Fig. 4.—Propeller Motor and Auxiliary Diesel Generator.

All oil-fuel plant, including pumps and heaters, transfer pumps and filters, is placed in two separate pump rooms situated between the forward and aft stokeholds; the oil-fuel pumps are electrically operated. Some 2,300 tons of oil-fuel is carried in twenty-two

tanks surrounding the boiler compartments, the tanks being filled from a central position on each side of the ship; the quantity of oil in each tank may be measured at any time by means of a Negretti & Zambra mercurial gauge.

Feed water for the boilers is supplied by two Weir steam turbo-pumps, and any loss of feed water is made up with fresh water from the double bottom tanks, which is purified by being evaporated in a low-pressure evaporator. The feeding arrangements are designed on the Weir closed system, and feed-water heating is in three stages, there being one surface heater on the discharge side of the water-extraction pumps and two surface heaters (one i.p. and one h.p.) on the discharge side of the turbo-feed pumps. Steam for the heaters is obtained from the main turbines and the exhaust from the feed pumps, and the feed temperature is about 300 deg. F.

The two water-circulating pumps for the main condensers are each driven by a variable-speed electric motor, and are cross connected to allow one pump to circulate water through both condensers; both pumps and motors are of W. H. Allen make.

Auxiliary Generators and Gear.—Owing to the large demand for electricity for heating, lighting, ventilation, and cooking, four auxiliary turbo-generators of B.T.H. make, each developing 500 kW, have been installed, as well as two solid-injection Petter oil-engine-driven generators, each of 165 kW. Two of the turbo-generators, fig. 5, are placed on each side of the engine room at the same level as the main turbo-alternators, while the oil-engine-driven sets are situated below and between the main thrust blocks.

The voltage of all auxiliary machinery, with the exception of that driven by Austin constant-current motors, is 220 V d.c. For supplying power to the Austin motors, three rotary convertors are placed on the port side of the engine room.

The main switchboard, flanked on the port side by the Austin control board, is at the aft end of the engine room and within view of the main starting platform. Among auxiliary machinery situated in the engine room is a Weir "Uniflux" auxiliary condenser with electrically-operated air and circulating pumps, bilge and ballast pumps, both driven by Austin constant-current motors, two sanitary and bath pumps of the Allen vertical electrical type, and two Drysdale "Centrex" electric fresh-water pumps; also a "Centrex" emergency bilge pump is situated in one of the fuel pump-rooms. An electric pump is placed in the forward stokehold for filling and emptying the swimming bath.

At the aft end of the engine room on the port side is situated the engineers' workshop, which is equipped with a lathe and drilling and grinding machines, all operated by independent electric motors. The ventilation of the engine and boiler rooms is of paramount importance in a vessel using highly-superheated steam and sailing in tropical climates, and eleven large ventilators have been installed for this purpose. That they fulfil their function admirably is proved by the pleasant atmosphere of the stokehold, where whiteclad stokers consult the oil gauges and control the valves.

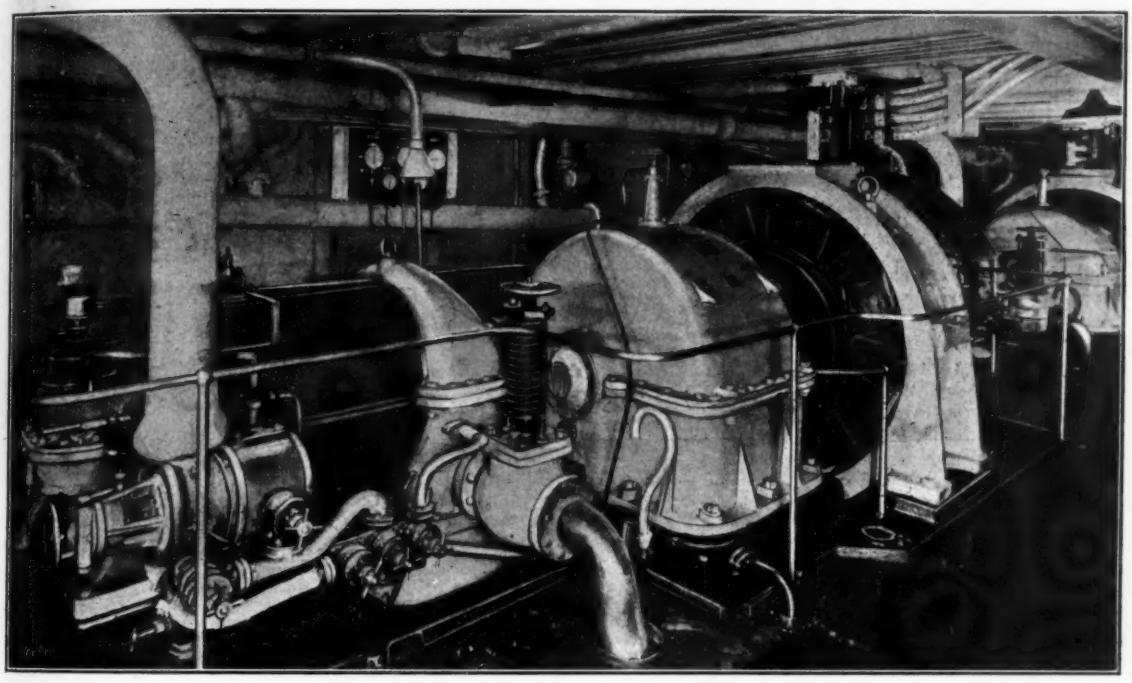


Fig. 5.—Two of the Four Auxiliary D.C. Turbo-Alternators.

At the luncheon on board Mr. A. E. Stephen, who presided, expressed the pleasure his firm had had in working with the owners' naval architect and their superintending engineer, Messrs. R. W. Rugg and R. T. Clarke, respectively. Mr. A. S. McLellan, director of the builders' firm, also paid high tribute to the makers of the electrical machinery who, he said, had spared neither trouble nor expense to make the *Viceroy of India* the best of her kind. He had been in America investigating the electric drive, and he had been amazed with what he had seen there and the boundless possibilities of electricity on board ships. So far they had touched only the fringe of the subject: he believed that the electric motor was the ideal drive for marine propulsion, as it gave everything that could be asked. The prime mover was a matter for the future: it might be the turbine, operating at higher steam pressure and temperature, but they had also to consider the possibilities of the Diesel engine. That was the first prime mover in connection with the electric drive, but it was only even yet in its infancy, because the Diesel engine should run at anything up to 1,000 r.p.m. or over; that was not an impossibility, it was now done in ordinary land practice, and suitable materials would enable a good marine engine to be made to run at a high speed. They had, to a large extent, learned the electric drive from America, but it was only a few years ago that the General Electric Co. of America acquired the last of Mr. H. A. Mavor's patents, for switchgear for marine propulsion.

Among other speakers was Mr. W. J. Belsey, marine superintendent of the British Thomson-Houston Co.

Progress in Shanghai.

New showrooms and offices have been opened by the Shanghai Municipal Electricity Department in the city area.

THE latest evidence of oversea activity in the electricity supply industry is information to hand concerning the recently established showrooms in the city area of Shanghai by the Shanghai Municipal Electricity Department. The accompanying illustrations will convey some idea of the extent, layout and general suitability of the premises.

The ground floor of the new building is utilised for the display of all kinds of electrical apparatus and current-consuming devices, and is completed by an information bureau where consumers, existing and prospective, can obtain first-hand knowledge and expert advice.

The greater proportion of the displayed apparatus is provided by various contracting firms interested in the sale of the various items, and while actual selling is not undertaken at the showroom, a system is in vogue whereby the contractor concerned is immediately advised of the selection of any displayed apparatus by a client, so that he can then take the requisite action for prompt delivery, payment, and so on. Fig. 1 shows the "shop front."

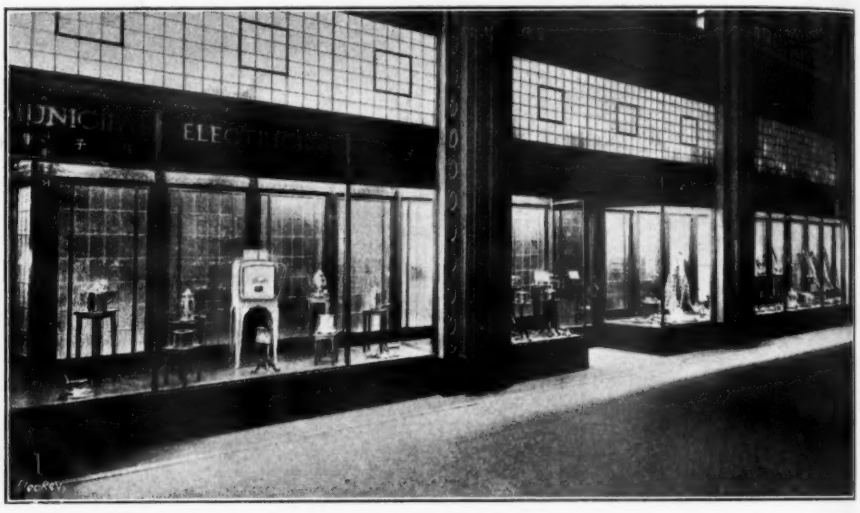


Fig. 1.—Exterior View of Shanghai Showrooms.

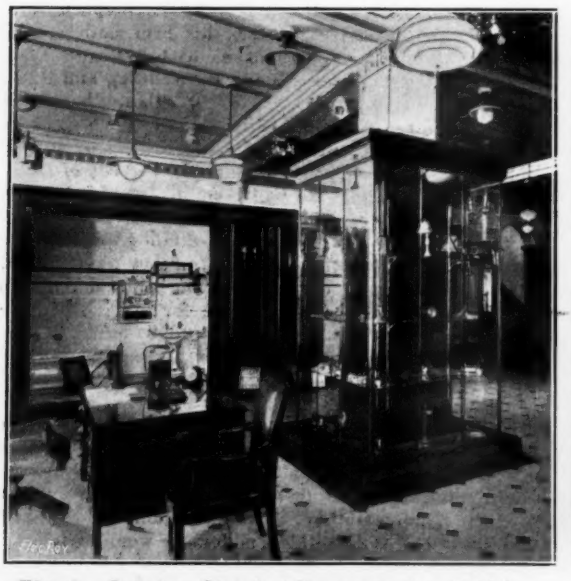


Fig. 2.—Interior, Showing Demonstration Cubicle.

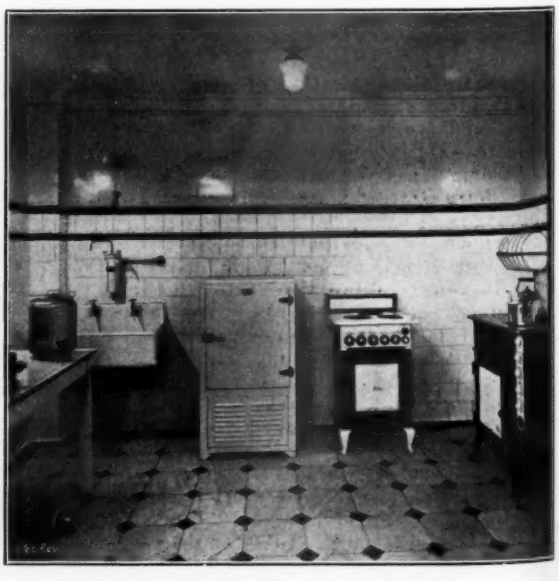


Fig. 3.—Electrically-equipped Kitchen.

It will be noted from fig. 2 that the showroom proper is provided with cubicle-type demonstration rooms suitably equipped to represent kitchens, bathrooms, and so on. All the apparatus is in actual working condition, and demonstrations are given periodically. A professional cook is always available to explain the economic operation of electric cooking apparatus, and when necessary an individual of like training is sent to consumers' premises to advise on the utilisation of cooking apparatus. Fig. 3 is a view in the demonstration kitchen.

The first floor of the new premises is devoted entirely to the collection of accounts, and is equipped along similar lines to a banking institution. An important feature is that in order to obtain access to the accounts department it is necessary for consumers to pass through the showroom; this arrangement is made so as to ensure that the attention of those concerned will be periodically directed to the latest available current-consuming devices displayed therein.

The Off-peak Heating Load.

Some further notes and figures showing its possibilities to the supply engineer, with particular reference to progress in Switzerland.

By L. G. A. SIMS, M.Sc. (Eng.).

(*Concluded from page* 370.)

To encourage consumers to adopt heat storage it has been necessary in Basle, as it will be necessary here, to offer special tariffs, and these have been developed in a scientific manner, the effect being calculated in every case to raise the level of the load curve of the town at those points where improvement is most needed. Thus the general tariff for week-time heating during off-peak hours (10 p.m. to 6 a.m.) is about ⅜d. per unit, but a cheaper tariff is offered, about one half of the above, for week-end heating. Here is a definite encouragement

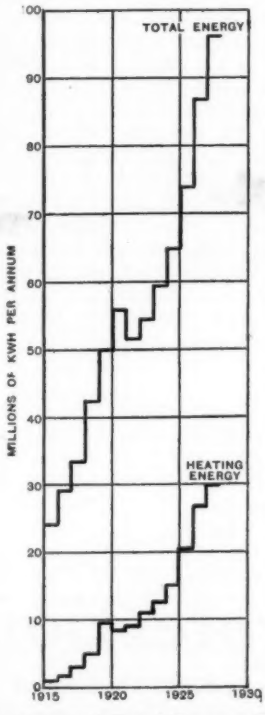


Fig. 4.—Heating and Total Energy Consumption.

to the consumer to improve the week-end load factor of the town, and at the same time to save himself money. As the Basle tariffs were fully analysed in these pages fairly recently,* it is not proposed to dwell on the subject, but a perusal of the translation made by Professor Cramp will prove fascinating, particularly in conjunction with the load curves for the town taken at intervals (figs. 1 and 2 of this article). Mention may now be made, however, of a further development which has not, so far as the writer knows, been dealt with previously, which illustrates the extent to which selective tariffs have been arranged. A rate of 0.9 centime per unit (about one third of a farthing) is offered to large works which are prepared to equip their steam boiler plant for electric heating, the price per unit being fixed to make it profitable to use this method of heating instead of coke firing. From the supply authority's point of view the sale of energy is advantageous even at this extraordinarily low rate, so long as it has the power to discontinue the supply at times when its load is heavy, or when its energy reserve is low. This power it has, and it is exercised when the Augst power station, from which the major portion of the Basle supply is taken, is short of water, owing to the seasonal variations of level of the Rhine, and during times of exceptionally heavy peak load. Extremely cheap energy is therefore available during the night and part of each day, and during the whole of the week-end, for a large part of the year. The beneficial effect upon the load factor of the station does not need stressing. The electric boiler plant is operated direct off the 6,600-volt 3-phase line, and is either combined plant arranged for both coke and electric heating ("doppelanlagen"), or run in conjunction with coke-fired plant. Such a tariff as that quoted above cannot be possible with a coal-fired generating station, nor would there be much room for it here, since our coke prices are lower than the Swiss prices, but the example shows the extent to which Swiss supply engineers have gone in encouraging the off-peak load. The following passage, taken from the 1926 report, is of interest in that it refers to this sale of surplus energy ("restenenergie"), and to the continued development of the lucrative off-peak domestic load on which the major improvement of the Basle load factor has been based:—

"The demand for heating energy increased by 32.4 per cent. if one includes the supply of surplus energy to electric and combined electric boiler plant, which is rapidly increasing each year, and 17.5 per cent. if one does not include this. . . . Omitting the large boiler plant, the increase of demand for heating purposes results, as in previous years, in the greatest part from new accumulation boilers, the number of which increased from 3,535 to 4,540."

The accumulation boilers are mainly domestic water heaters, and the figures given are for the year 1926. The 1927 report shows a still greater increase in their number, with a consequent increase of heating energy demand of about 18 per cent. It was in 1928 that the revenue from the sale of heating energy, mainly at cheap off-peak rates, exceeded one million Swiss francs, or £40,000. Fig. 4 shows the growth of heating energy consumption, compared with the growth of the

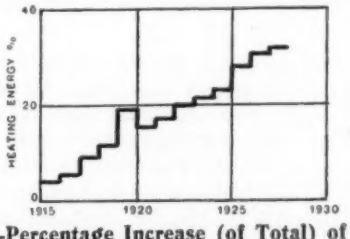


Fig. 5.—Percentage Increase (of Total) of Heating Consumption.

total energy consumption, and from fig. 5 it can be seen that the former represents an ever-increasing fraction of the total.

The secret of the 80 per cent. load factor of Basle is, therefore, not difficult to discern. It has been achieved by keen business methods on the part of the supply authority, which has taken every opportunity of selling its energy reserves by a series of carefully graded tariffs in conjunction with protective clauses, where the safe minimum reserve might have been endangered.

Turning now to our own country, we find on good

* "Electricity Supply Tariffs," Prof. Wm Cramp, ELECTRICAL REVIEW, January 28th and February 4th, 1927.

authority that the average load factor of the whole country is under 25 per cent.¶ As stated previously, we find also that only about three supply authorities' undertakings in the whole country offer an attractive tariff for the storage heating of water, and that other forms of heat storage are practically unknown. On the other hand, we have to consider the important difference between this country and Switzerland which results from our lack of water-power. In Switzerland water-power produces the bulk of the electrical energy used, and capital charges on the station form the greatest part of the generating costs. It is, therefore, of more importance to the Swiss to utilise their water sources continually (since only a small fraction of their revenue is absorbed by operating costs) than it is to us to generate from coal for which we have to pay, but it would be fallacious to argue from this than an off-peak load is not of importance here. Taking the figures quoted by Sir John Snell, we have for the modern station with a load factor of 40 per cent. to 50 per cent., the following allocation of generating costs:—Coal, 46 per cent., capital charges, 40 per cent., other charges, 14 per cent., an average cost of coal of 20s. per ton, and an average calorific value of 10,500 B.th.u. per lb. On the basis of these figures we may arrive at an estimate of the average generating costs per unit in this country, omitting capital charges. Taking 18 per cent. as a fair value for the thermal efficiency of a modern large station, we have for the cost per unit generated about 0.193d. due to coal. Adding 14 per cent. for costs other than capital charges gives us about 0.252d. per unit. The above figures may be considered to apply more particularly to the large station, but, on the other hand, while the thermal efficiency may do so, there are many stations which buy coal at less than 20s. per ton, and some which generate with a thermal efficiency in excess of 18 per cent. But we may say that a generating cost of one farthing per unit, omitting capital charges, should be possible with the average modern steam plant, efficiently run, and we may form a rough estimate of the possible revenue to be expected from an off-peak load.

Assuming a tariff of $\frac{3}{8}$d. per unit, we have the margin of $\frac{1}{8}$d. gross profit per unit sold. From figures which the author has published previously for Basle, we know that a daily household demand for hot water will be about 44 gallons for all purposes, or a yearly consumption of about 4,800 units. The annual profit per consumer may therefore reach about £2 10s. The number of consumers required to yield a profit of £10,000 per annum to the supply authority on the above basis is 4,000. The number of consumers connected 3 years ago in the town of Basle, which has a population of only 145,000, had reached this figure. At the present time the number of consumers in the town is such as to yield a profit of £15,000 per annum, reckoned on the above basis, *that is, on the possible British generating costs.* Why, therefore, should not our larger towns, almost without exception, fix attention upon the possibilities of the off-peak load? Even if a tariff of $\frac{1}{2}$d. per unit is needed to yield a reasonable profit, the business can be made attractive to the consumer. All the evidence of those who have experience of off-peak water heating is to the effect that consumers are enthusiastic advocates of the system.

But the load will not be popularised simply by the introduction of a tariff. The tariff must be instituted in conjunction with a hire or hire-purchase scheme to assist consumers to meet the rather high cost of heat-storage apparatus, and with an active sales campaign. It is on these lines that the Swiss scheme has been made successful. It is impossible to foster an electrical water-heating load by attempting to persuade prospective consumers to purchase outright apparatus of appreciable capacity, as the first cost is too great.

There are at present about $1\frac{1}{4}$ million houses wired for electricity supply in this country. Of these we may say that practically none have at the present time any form of electrical heat storage equipment. There are, moreover, about $5\frac{1}{2}$ million houses available for wiring, an appreciable proportion of which may be wired during the next 10 years. If we wish to improve our load factor from the present average of 25 per cent. to the 80 per cent. enjoyed by the town of Basle, we have the material to work upon, and we may be quite certain that, given the tariff and suitable purchase terms, the householder will not be slow to appreciate the advantages to himself of storage heating, particularly the heating of water.

In conclusion, the writer wishes to acknowledge valuable assistance given by Mr. J. Ammann in the preparation of this article, and the kindness of Herr Gengenbacher, of the Basle electricity works, in furnishing information.

¶ "The Present and Future Development of Electricity Supply." Sir John Snell. Presidential Address, Section G, British Association, 1926.

H.P. Networks Protection.

The protective system adopted by the Union d'Electricite for its 60,000-V network is based on the utilisation of the out-of-balance power components during fault conditions.

By C. W. OLLIVER.

THE problem of the selective protection of power networks is one of increasing importance. The fact that any accidental phonemonon which may occur on a network—at any rate during the first few tenths of a second of a fault duration—leads to currents and e.m.f.'s that are out of balance, affords a singularly effective method of obtaining satisfactory protection by the utilisation, not of the phase currents and voltages themselves, but of their single-phase components to operate suitable relays.

It is thus possible to make use of the out-of-balance power components to operate wattmeter relays, and they may be easily designed for high sensitivity, since they carry no heavy currents under normal conditions. A further advantage is to be found in the fact that the phase angle between the voltage and current components used is better defined, whatever the nature of the fault or whichever phase is affected, than would be the case if the phase currents and voltages were directly made use of. The methods of protection used by the Union d'Electricité are based on these considerations.

In the following notes the term "reverse power" is used to denote the reverse component of the power which is equal to the product of the reverse components of current and voltage, and the term "single-phase power" is used to denote the single-phase component equal to the product of the single-phase or residual components of current and voltage. Single-phase power occurs

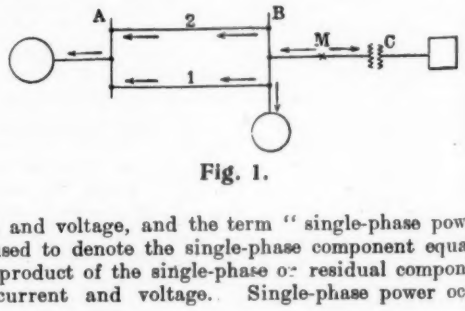


Fig. 1.

when one or two phases are earthed, and reverse power in all cases when a dissymmetrical short circuit occurs.

Considering a network such as that shown in fig. 1, in which A and B are generating stations, and C a sub-station, with a dissymmetrical short circuit on the sub-station feeder at M, it may be shown that, in effect, the results are such as would be produced if the reverse and single-phase power were generated at M and transmitted from that point to all parts of the network, the impedance of which, in relation to the reverse and single-phase power, was finite. The reverse power from M, therefore, travels on the one hand towards the generating stations A and B, the only impedance opposed by the alternators being the leakage reactance, and on the other hand towards the sub-station C; the impedance of the utilisation network is lower the more the rotating machinery installed, either of the synchronous- or the induction-motor type. Similarly, the single-phase power travels to A and B, the neutral points being earthed at these stations. Between M and C, the single-phase power is zero if the neutral is insulated, or travels from M to C if the neutral is earthed. The impedance in this case varies according to the way in which the transformers are coupled. For the sake of clarity we will call the direction positive from line to adjacent busbars, and negative in the reverse case.

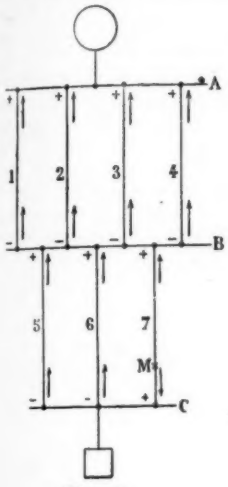


Fig. 2.

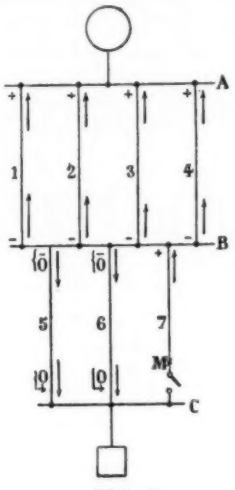


Fig. 3.

It is possible to obtain fault selection on lines in parallel if we know, at each extremity of the line, the direction of the reverse power (or of the single-phase power) which is indicated by means of a wattmeter connected at that point.

Turning to fig. 2, we have two sets of lines in parallel comprised between two stations A and B on the one hand, and B and C on the other. Supposing a short occurs at M. The direction of circulation is shown on the figure. On lines 1, 2, 3 and 4, it is positive at A, negative at B. On lines 5, 6 and 7, on the other hand, there will always be one extremity (C in the present example) where the power is positive on line 7 and negative on lines 5 and 6.

It will consequently be possible to devise a relay system which will cut line 7 at its extremity C When this occurs, the arrangement is that shown in fig. 3. At station B the reverse power is still positive on line 7, but it becomes zero or negative for lines 5 and 6. It is therefore now possible to install a relay system identical to that at 6, which will cut out line 7 at the extremity B, finally putting the defective line out of commission.

The above remarks may be summed up as follows:—When lines connected in parallel are working under normal conditions, the power at any given extremity is either positive, negative, or zero, and is the same for all the lines. If a fault occurs on any line, the power is positive at both its extremities, and differs at least at one extremity from the other lines where the power is either negative or zero.

The problem therefore reduces itself to devising a system which will remain inactive so long as the power is zero or of the same sign in the network considered, but which will operate and cut out the defective line where the power is positive when the power is negative or zero in the other lines.

The method used consists in the installation at both ends of each line of a wattmeter relay of very rapid action operated either by the reverse or by the single-phase power. The system is illustrated in fig. 4, as applied to three lines operating in parallel, and as installed at one end of the lines.

The tripping coils B_1, B_2, B_3 are connected to a stud p_1 of the relay on the one hand, and on the other hand, to one of the poles of a local accumulator battery. The relays are also provided with studs p_2, which are connected to the opposite pole of the battery through the contactor C which are themselves part of the corresponding circuit breakers. Each of these contactors is opened or closed with the circuit breaker and isolates the relay stud when the line is not in operation, or has been cleared. The relays are so connected that the electrical torque produced brings the moving element up against p_1 when the power is positive and against p_2 when the power is negative.

It will thus be seen that—

(1) When the power is negative or zero in all three lines, the moving elements of all three relays will be in position p_1, and there will be no action.

(2) When the power is positive in all three lines, the moving elements of all three relays will be in position p_2, and there will be no action.

(3) If the power is positive in one of the lines and negative or zero in the others, one of the moving elements will be in position p_1, the others in position p_2. The tripping coil corresponding to the defective line will operate the circuit breaker.

In practice the arrangement is not quite so simple as that illustrated, because the relay contacts have not sufficient surface to feed the tripping coils direct, on account of their high degree of sensitivity. Auxiliary relays are therefore introduced into each circuit, but the principle of operation, of course, remains the same.

It will be seen from the above that this method of protection is very simple, and can easily be extended to deal with any number of lines in parallel. The method is quite independent of the length of the lines

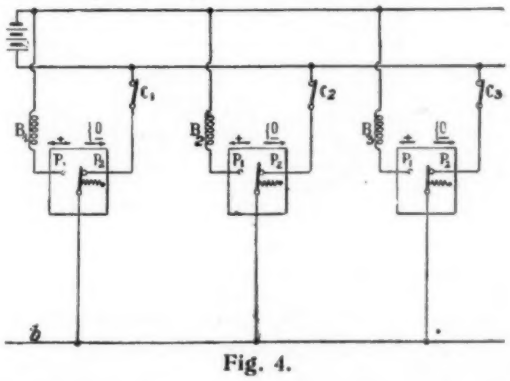


Fig. 4.

or of the power involved, and feeders or lines can be switched in or out of circuit without interfering with the protection system as a whole. Since the relays operate on the "all or nothing" principle, the effectiveness of the protection is quite independent of the metering transformers used. The only disadvantage of the method—one which is shared by many other systems—is that the breakers at either end of the defective line operate successively and not simultaneously. The use of very rapid relays minimises this trouble, and experiments have shown that the time required to clear a line at both ends is of the order of 0.5 to 0.75 second.

The system is used by the Union d'Electricité on its 60,000-volt cable network, and is being extended to its 60,000-volt overhead and 13,200-volt cable networks.

The Electricity Commissioners' Work.

Brief Extracts from their Eighth Annual Report, for 1927-28.

(*Concluded from page 375.*)

Special Orders in Force.

Inclusive of certain Orders confirmed by the Minister of Transport during the period covered by the previous report, 70 in all were submitted to and approved by Parliament during the year under review.

Sanction of Loans.

At the commencement of the period covered by this Report, 170 applications for sanction to borrow money were under consideration, and during the year under review 768 further applications were received. While the great majority emanated from individual local authorities, certain of them were made by Joint Boards and by Joint Electricity Authorities. Sanctions in full, or in part, were issued by the Commissioners in 751 cases. Allowing for 25 applications which were refused, withdrawn, postponed, or transferred to other Departments when they involved borrowing for purposes not dealt with by the Commissioners, 162 applications thus remained under consideration at March 31st, 1928.

The total amount of the loans sanctioned during the year, less certain cancellations, was £18,020,063, representing an increase of over 17 per cent. on the figure for the preceding year. The applications included a number relating to important schemes of development, and sanctions amounting to over one million pounds in each case were issued to the West Midlands Joint Electricity Authority (£1,886,000), the Corporation of Liverpool (£1,617,540), and the Corporation of Bristol (£1,396,689); in the first-mentioned case, a substantial proportion of the amount sanctioned was for the purpose of enabling the Joint Authority to complete the purchase of existing generating stations in the electricity district. Sanctions amounting to £500,000, or over, were issued in three further cases, namely, to the Corporations of Birmingham, Leeds, and Manchester, while 31 other undertakers received sanctions amounting in total to upwards of £100,000 in each instance. On comparison with the previous year the resultant increase of £2,736,168 in the amount sanctioned was mainly attributable to the large increases in respect of mains and services and "other purposes"; the last named included £1,130,000 in respect of the purchase of generating stations by the West Midlands Joint Electricity Authority, and £323,442 in respect of the acquisition of electricity undertakings by seven other authorities, including the Corporation of Bromley and the Urban District Council of Walton-upon-Thames. The amount under "other purposes" for wiring consumers' premises and for the purchase of domestic apparatus for hire or hire-purchase was £539,404, the corresponding figure for the previous year being £400,941. Of the £102,587,184 sanctioned in the course of eight years, approximately 43 per cent. was for the provision of generating plant, boilers, condensing plant, motors, converters, transformers, switchgear, &c.; about 39 per cent. for main transmission lines, overhead lines and underground mains, services, &c.; and the remainder for a variety of other purposes (land, buildings and other permanent works, meters, wiring, domestic apparatus, &c.), including the acquisition of established undertakings.

Surplus Revenue.

By the Act of 1926 the provisions with respect to the application of electricity revenue by local authorities was amended to enable the undertakers, with the consent of the Commissioners; to apply the net surplus remaining in any year and the annual proceeds of the reserve fund when amounting to the prescribed limit in payment of expenses chargeable to capital on distribution works, such as house services, meters, wiring of premises, provision of apparatus on hire or hire-purchase, and other comparatively short-lived works. The Commissioners gave general consent enabling net surplus to be applied in payment of expenses of providing works of the above-mentioned kinds in any case where the reserve fund of the electricity undertaking was not less than 1/20th of the aggregate capital expenditure, subject however to the amount so applied being not more than 5 per cent. of the revenue of the year in which the surplus was obtained.

The Local Authorities (Emergency Provisions) Acts, 1923-1927, empowered the borrowing of money, with the consent of the Minister of Health, temporarily for current expenses. Of the applications during the past year, nine were in respect of electricity undertakings and were referred by the Minister to the Commissioners for their observations.

Systems of Supply.

The Commissioners approved of the adoption by seven authorised undertakers of systems of supply other than the general systems previously approved, and of the alteration of the declared system and/or pressure hitherto adopted by 29 different authorised undertakers.

Bulk Supplies.

Further progress was made with bulk supply developments, as indicated in Table I.

TABLE I.—Bulk Supplies Taken and Arranged.

Source of Bulk Supply.	Number including cases of reciprocal supplies. By Local Authorities.	By Companies.	Totals.
From local authorities ...	87	56	143
From companies	120	89	209
From non-statutory and miscellaneous	23	20	43
Totals	230	165	395

There was an increase of 44 in the number of supplies taken or arranged for, and the above approximate figures are inclusive of supplies derived from more than one source by individual undertakers. In the case of the supplies (352) taken, or arranged, from authorised undertakers, the bulk suppliers numbered 88 separate local authority undertakers and 45 separate company undertakers; the Commissioners gave their approval in 36 cases to certain authorised undertakers entering into and carrying into effect arrangements for mutual assistance, or for bulk supplies; 32 were given under the general Acts, two under the provisions of district orders, and two under the provisions of special Acts.

Consumers' Apparatus.

The extent of the liability of an undertaker, on a change-over of his system and/or pressure, in respect of consumers' apparatus replacement cost formed the subject of a conference between the Commissioners and representatives of the principal Associations of the electricity supply industry. After a careful review of the legal position, the Commissioners were advised that it was open to doubt whether any condition of supply made by the undertaker and purporting to require the consumer to give notification of additional apparatus subsequently installed could be enforced in view of the provisions of Section 18 of the Act of 1882; and that the attachment to a consent to a change of system of any condition purporting to confer on the undertaker some measure of control over apparatus installed by a consumer would be open to objection on legal grounds. The Commissioners were advised that it would be open to them to make provision in their consent whereby in cases of the undertakers being prepared to give individual notification to consumers within a reasonable period before the date actually fixed for effecting the change-over of the consumers' apparatus, no liability should rest on the undertakers in respect of additional apparatus installed by the consumer between the date of such individual notification and the date of change-over unless otherwise agreed between the undertakers and the consumer.

The Commissioners subsequently adopted a modified form of consent on the lines indicated above, and notified the Associations accordingly in May, 1928.

Regulations.

The Commissioners reviewed the Code of Overhead-Line Regulations and adopted a revised code embodying a number of relaxations. They also reviewed existing codes of regulations for ensuring a proper and sufficient supply of electrical energy and for securing the safety of the public made by the Board of Trade under the Electric Lighting Acts, and had prepared a preliminary draft of a consolidated code, based in the main upon the suggestions embodied in a draft submitted by the Committee of the Institution of Electrical Engineers, but had not concluded their consideration of the matter.

The Commissioners served notices and prescribed regulations for securing the safety of the public and for the protection of the electric lines and works of the Postmaster-General in 32 cases of electric lines and works being erected without statutory authority.

Fringe Orders.

The Commissioners granted 101 orders during the year permitting various authorised undertakers to supply electricity to specific premises situated outside their respective areas of supply. They revoked two Fringe Orders previously granted

to the Hendon Electric Supply Co., Ltd., on being satisfied in each case that the North Metropolitan Electric Power Supply Co., in whose area of supply the premises were situated, was in a position to supply the premises on reasonable terms and had agreed to take over the supply from the Hendon Co.

Railways.

The Commissioners issued two consents to (i) London and North-Eastern Railway Co. to supply electricity from its generating station to the premises of Edme, Ltd., of Mistley; (ii) Metropolitan District Railway Co. and the London Electric Railway Co. to supply electricity from their generating station to the occupants of the new office building adjoining St. James' Park station, Westminster, erected by the Metropolitan District Railway Co.

Transfer of Undertakings.

Deeds of transfer of undertakings were approved in 17 cases.

Loss of Office.

Claims for compensation for deprivation of employment, &c., were referred to the Commissioners in two cases, and a number were dealt with by the referee appointed by the Minister of Labour. The awards made were as follows:—24 claimants £2,132 total; five claimants £340 total; one claim £90; three claims £260 total; ten claims £805 total; one claim £1,500.

Research.

The Commission contributed £1,000 to the B.E.A.I. Research Association towards the cost of e.h.p. transmission investigations.

Charges for Electricity.

During the period covered by this Report, a considerable amount of correspondence was received by the Minister of Transport, and also by the Commissioners, containing representations, or complaints, with regard to the prices charged for electricity. Practically all had reference to company undertakers, and many of them related to the supply of electricity in various portions of the London and Home Counties District.

A communication addressed to the Commissioners by the London and Home Counties Joint Electricity Authority stated that in connection with the consideration of complaints relating to the charges made for electricity in certain metropolitan boroughs and other parts of the electricity district, a summary had been prepared of the rates of charge in existence in October, 1927, and that the complaints received and the wide range of existing charges justified the suggestion that a comprehensive investigation should be made into the whole subject. The matter is under consideration by the Commissioners.

At the commencement of the year under review, five applications for downward revisions of maximum prices were under consideration; and in the course of the year six further applications were made to the Minister, five being in respect of downward revisions, and the other being from an authorised undertaker who sought an upward revision of maximum prices.

Overhead Lines.

The persistent growth since 1920 in the annual number of applications made by authorised undertakers to the Minister of Transport for consent to the erection of overhead lines bears evidence of the increasing extent to which recourse is being made to use them for transmission and distribution in rural and other areas outside the more congested centres of population. The Commissioners dealt with as many as 391 applications, an increase of 63, or over 19 per cent., on the number dealt with in the preceding year. In 112 cases the applications were from local authority undertakers, in 99 cases from electric power companies, and in 180 cases from other company undertakers. The Commissioners were able in the great majority of cases to recommend the Minister of Transport to give his consent, but in certain cases objection was taken by the local authority or the county council to the placing of lines overhead. The Minister gave his consent in respect of 376 of the abovementioned applications, the remaining cases being still under consideration. The developments represented by individual consents ranged from short distributors for supplying particular consumers up to high voltage transmission lines several miles in length.

The increased activity in overhead-line development was reflected in the number of applications for the consent of the Minister of Transport to wayleaves. The Commissioners dealt with 107 applications in all, as compared with 53 in the preceding year, the former figure including two prior applications which involved further consideration in the period under review. In eleven cases the parties concerned arrived at a settlement and the applications were subsequently withdrawn; in 87 cases the Minister gave his consent after local inquiries had been held; and the nine remaining cases were under consideration. The consents were subject in each case to conditions, the wayleave rentals being prescribed by the Minister.

Private Parliamentary Bills.

The Commissioners, on behalf of the Minister of Transport, examined the provisions relating to the supply of electricity included in the private Bills and Scottish Provisional Orders deposited for the session of 1928, and in 31 cases advised the Minister in conection with the reports required to be made by him in accordance with the standing orders of Parliament.

Staff and Organisation.

As in the previous year, the Commissioners retained the professional services of certain consulting electrical engineers to assist in the technical investigations arising in connection with the preparation of schemes under the Act of 1926. To enable the increasing volume of administrative work to be dealt with they also found it necessary to make additional junior appointments to their staff, which numbered 68 in all, and consisted of 35 established officers and 33 unestablished and temporary officers, inclusive of typists and messengers.

The estimated net cost of administration for the year 1927-28 was £51,440, inclusive of provision of £3,000 for unforeseen contingencies. After allowing for a reduction of £7,440 in the working balance, the total amount to be apportioned among authorised undertakers was £44,000, as compared with £51,000 in the preceding year. With regard to the apportionment of the estimate on the basis of "units of electricity sold," the certified returns submitted for the year ended December 31st, 1926, showed that 5,723,653,523 kWh was sold by authorised undertakers in Great Britain during that year. The corresponding figure of units sold in the year ended December 31st, 1927, was 6,850,162,808. The contributions by the electricity supply industry towards the expenses of the Commissioners for 1927-28 thus involved a payment amounting to 1.84d. per 1,000 kWh sold by each authorised undertaker concerned.

The expenses of the Commissioners relating to the interest and sinking fund charges repayable to the Central Board in respect of the cost of standardisation of frequency will be shown as a separate item in the accounts and demand notes of the Commissioners, and will be apportioned among authorised undertakers on the basis of the revenue received from the sale of electricity, other than electricity sold in bulk to other undertakers.

The year closed with an increase in the working balance of £1,139, as against an estimated reduction of £7,440, the net expenditure thus falling short of the estimate by £8,579, mainly accounted for by the fact that the contingency provision of £3,000 was not drawn upon, by the increase in receipts due to fees on applications for special orders, and by the increased interest earnings on the larger cash balances in hand during the year.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Electricity Schemes.

On February 26th, Mr. Kelly asked the Minister of Transport if he would state the schemes put forward by the Electricity Commissioners during 1927 and 1928 to the Central Electricity Board.

Colonel Ashley said that the following five schemes were transmitted by the Electricity Commissioners to the Central Electricity Board during the years 1927 and 1928:—The Central Scotland Scheme, the South-East England Scheme, the Central England Scheme, the North-West England and North Wales Scheme, and the Mid-East England Scheme

Electricity Charges at West Wickham.

On February 26th, Mr. Day asked the Minister of Transport whether he had received a protest from a large number of the residents of the new housing estate, West Wickham, against the high charges made by the West Kent Electric Co. for electricity, and whether his department was taking any action in the matter.

Colonel Ashley said he did not appear to have received any such protest.

Scottish Water Power Bills.

It is stated that 95 petitions have been presented against three Scottish water power Bills—the Galloway, West Highland and Grampians Bills. These measures have been referred to a Select Committtee of the House of Lords under the chairmanship of Viscount Younger.

Electrically-illuminated Direction Lines.

On February 27th, Sir Nicholas Grattan-Doyle asked the Minister of Transport whether his attention had been called to the possibilities of electrically-illuminated white traffic-direction lines on roads; and whether it was his intention to suggest to road authorities that facilities should be given for experimenting with such devices.

Colonel Ashley said he was giving consideration to the possibilities of electrically-illuminated white traffic-direction lines, and was arranging for certain trials to be carried out. He did not consider it desirable to make any special suggestion to highway authorities at the moment.

London and Home Counties J.E.A. Bill Withdrawn.

It is announced that the Bill which was being promoted during the current session of Parliament by the London and Home Counties Joint Electricity Authority has been withdrawn. This is the outcome of the injunction recently granted against the Joint Authority at the instance of the Attorney-General acting on behalf of a number of London electricity supply companies.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Local Exhibition.

Morecambe.—We have received from Mr. M. J. Mortimer, the borough electrical engineer, a copy of a booklet which was distributed during the recent Chamber of Trade Exhibition, in which the Corporation Electricity Department arranged an electrical section. It is written in an interesting way around the various applications of electricity, and contains brief descriptions of the stands of the exhibitors, among whom were: The Revo Electric Co., Ltd., the Central Electric Co. (Morecambe), Mr. G. W. Dawson, the Singer Sewing Machine Co., Burnley Components, Ltd., and Messrs. E. & W. Shepherdson, Ltd. Some notes on the electricity undertaking and a full statement of charges for electricity are also included. The booklet was distributed to nearly 7,000 people.

Lighting in Melbourne Town Hall.

The accompanying illustration presents a view of the interior of the Town Hall, Melbourne, showing the handsome nature of the decorations as well as indicating the size of the building. A special feature is the lighting which has been carried out with fittings supplied by the British General Electric Co., Ltd.

Lighting in the Town Hall, Melbourne.

Leyton and Electricity Meters.

The Leyton Urban Council has adopted a recommendation from the Electric Lighting and Tramways Committee not to accept a tender for a large quantity of electricity meters, but that the electrical engineer should purchase meters as and when required, and if unable to obtain them from British firms at prices reasonably near those quoted by foreign firms to purchase suitable meters from foreign firms. When the matter was discussed on February 26th, a motion to refer the matter back in order to have a definite resolution to purchase foreign or British meters was rejected. Councillor Marlow, who proposed this, said that it meant a matter of 4s. 6d. each, but he thought that it would in the end be a wise policy to buy the British meters. Councillor Thorn replied that they were not prepared to accept the tender of a British firm when it meant buying 4,000 meters.

Hampstead Undertaking to Pay off Debt.

At its meeting on February 28th the Hampstead Borough Council decided to pay off all outstanding loans on its electricity undertaking (engineer: Mr. J. Leadbeater), amounting to £32,310, out of accumulated surplus, thus leaving the undertaking free from debt as from March 31st. It is believed that Hampstead will then occupy a unique position in the electricity supply industry. The prices charged to Hampstead consumers are among the lowest in the country, *viz.*, 3d. per kWh for lighting, and ¾d. per kWh for power, heating, and cooking.

Cable Manufacture in Russia.

A Moscow newspaper states that the production of cables in Soviet Russia during the fiscal year 1925-26 exceeded the level of that in the pre-war period, while during the current year the output will be two and a half times greater. It is, however, calculated that it will only be possible to meet the demand to the extent of 55 to 60 per cent. this year owing to the shortage of copper and other non-ferrous metals.

Book Notices.

"Sell's Directory of Registered Telegraphic Addresses, with Telephone Numbers and Classified Trades." London: Business Directories, Ltd. Price 45s.—With this, the 1929, edition this useful publication attains its 44th year. The new and improved system of reference introduced last year is continued in this issue, the Press section has been greatly improved, and several new features have been added, including a special section of American exporters, merchants, Customs brokers, &c., also a Stock Exchange section containing the official lists of stock and share brokers, who are members of the respective Stock Exchanges in Great Britain and Ireland.

"The Official South African Municipal Year Book, 1928-29." Pp. 520 and tables. London: E. G. Allen & Son, Ltd. Price 25s. net. The 1928-29 volume of this municipal year book has been thoroughly revised and brought up to date. The statistics relating to the municipalities of South Africa reflect steady progress in every direction. It is stated that during the past year numerous new undertakings have been laid down in the four provinces, consequent upon the Electricity Supply Commission being in a position to undertake the supply of electricity in bulk from its superpower stations.

"Aircraft Engineering," a monthly publication devoted to the science and practice of aeronautics and to allied and subsidiary branches of the engineering industry. Vol. I, No. 1. March, 1929. London: 110, Fenchurch Street, E.C. Price 2s.

"Whittaker's Electrical Engineer's Pocket Book," 1929. Sixth edition, revised and enlarged; pp. xiii+775; figs. 356. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.—The 1929 edition of this Pocket Book has been completely revised, important changes and additions have been made in practically every section, and the book has been entirely re-indexed. Entirely new sections have been added dealing with: Electrical Legislation, Industrial Electric Heating, Oscillographs and Wave Analyses, Applications of a.c. Commutator Motors, Rewinding a.c. Motors for different voltages and frequencies, Balancers, Boosters, and Reducers, Mercury Rectifiers, and Transverters. Previously existing matter has been replaced by up-to-date information where necessary, and the size of the book has been increased by about 100 pages, including many new illustrations.

"Fundamentals of Electrical Design." By A. D. Moore. London: McGraw-Hill Publishing Co., Ltd.—We regret that in our review of this book, in our issue of January 18th, the price was given as 25s., whereas it is actually 20s. The reviewer, with the erroneous price in mind, said that the work would "command a wider sale at about 75 per cent. of its price"; if this is accepted then the actual price is not far out.

Olympia to be Reconstructed.

It was announced last week that Olympia, Kensington, W., had been purchased by Mr. P. E. Hill, chairman of Covent Garden Properties, Ltd. It is the purchaser's intention to reconstruct and enlarge the building to make it one of the finest trade exhibition centres in the world. The work is to commence almost immediately, and is expected to be completed before the end of next year.

Overseas Trade Inquiries.

The Department of Overseas Trade says that before initiating correspondence on commercial matters with overseas officers of the Department, British firms should bear in mind that the Department may have at its headquarters, 35, Old Queen Street, S.W.1, the information which they require or may have helpful advice to offer on the matter about which they contemplate correspondence.

A Hackney Window Display.

It is the policy of the Hackney Corporation Electricity Department to co-operate with manufacturers in the dressing of its showroom windows. In this way expert assistance is obtained with correspondingly effective results. One of the latest displays dealt with "Osram" lamps, and the illustration reproduced herewith shows that it was novel and attractive. The centre piece, as is explained, illustrates various stages in the manufacture of the lamps.

An "Osram" Display at Hackney.

Social Events.

The annual staff dinner of the Cardiff Electricity Department was held at the Grand Hotel, Cardiff, on March 1st, Mr. C. G. Morley New (city electrical engineer) presiding over a large company, which included representatives of the leading manufacturing and distributing firms and local contractors. The toast of the "Cardiff Corporation Electricity Department" was given by Mr. Arthur Ellis (former chief of the department), who referred to the phenomenal growth of the undertaking and the favourable charges for electricity. In wishing the Department further success, he hoped the burden of the recent re-assessment figures, which were increased from £7,000 to £40,000, would be borne with equanimity. Replying to the toast, Councillor Gough (chairman of the Electricity Committee) said that unfortunately the undertaking was regarded by some members of the Council as a milch cow for the relief of rates. That was not its primary function. Their aim was to provide a cheap and abundant supply of electricity, to take their share in industrial reconstruction and give industry a chance to regain its lost position. The toast of "Our Visitors and Guests" was proposed by Mr. E. Jones, mains superintendent, Mr. J. Williams responding; Mr. R. L. Booth, chairman of the Cardiff Branch E.C.A., proposed the chairman's health, and Mr. Morley New briefly replied. Musical items were given by members of the Cardiff Grand Opera Society.

The students of the Brush Electrical Engineering Co., Ltd., held their annual dance at the Town Hall, Loughborough, on February 22nd. About 120 guests attended, amongst whom were Mr. W. Johnstone (managing director), Mr. A. T. Brotherton (works director), and Mr. F. G. Healey (secretary). Mr. W. H. Cooke, chief electrical engineer, Luton Corporation, was also amongst those present. A very enjoyable evening was spent, a feature being the attendance of a number of ex-students who make this dance the occasion of an annual reunion.

The annual dinner and concert of Evershed's Social and Athletic Association (Evershed & Vignoles, Ltd.) was held on February 23rd, at the Clarendon Restaurant, Hammersmith. Mr. Vines, President of the Association, occupied the chair, and after the dinner there was a very successful concert by staff and works employés.

The committee of the Igranic Electric Company's Rugby football team is to be congratulated on a successful dance which was held on March 1st at the Crofton Rooms, Bedford. Over 200 guests were present.

Australian Trade Development.

The Commonwealth Government has decided to set up a Trade Commissioner service in various overseas markets, including the United States. The first appointment is being made to Canada.

Wages in the Cable Making Industry.

The Joint Industrial Council for the Electric Cable-Making Industry announces that there will be no cost-of-living change in wages in the industry on the third pay-day in March.

Hull Cable Contracts.

Several tenders for cable were considered by the Hull Corporation Telephones Committee on February 27th, and in each case the lowest tender (whether British or foreign) was accepted. Where the difference was only £2 or £3 a motion to accept a British tender was defeated, and the German tender accepted.—*Yorkshire Post.*

The F.B.I. and Industrial Conferences.

At a special meeting on February 26th, the General Council of the Trades Union Congress accepted the invitation of the Federation of British Industries and the National Confederation of Employers' Organisations to discuss the possibilities of joint consultation upon matters of common interest. As was mentioned in our last issue, it is the intention of the employers' representatives to explain their unfavourable attitude towards the "Melchett-Turner" conferences. It is probable that the suggested meeting will be held at an early date.

Recent Contracts.

The contract for the emergency lighting sets for the Canadian Pacific liner *Empress of Britain*, now being built at the yard of Messrs. John Brown & Co., Ltd., Glasgow, has been placed with the Parsons Oil Engine Co., Ltd., of Southampton. The plant will consist of two of the company's "T6SO" paraffin engines direct coupled to 75-kW generators of Messrs. W. H. Allen, Sons & Co.'s manufacture. The company is also supplying the emergency sets for the C.P. liner *Empress of Japan.*

Messrs. Clough, Smith & Co., Ltd., have received a contract from the Doncaster Corporation for the conversion of a further section of the tramway system. The contract includes the reconstruction of the overhead equipment and the supply of six additional "Karrier-Clough" six-wheel double deck trolley-omnibus chassis.

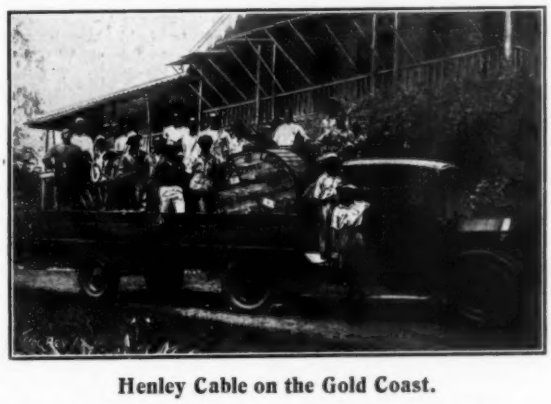
Lighting Fittings for Kansas City.

The British Consul at St. Louis, Missouri (Mr. W. K. Small, M.B.E.) reports that a firm in Kansas City is desirous of importing electric lighting fittings and brassware, such as andirons and candlesticks. United Kingdom manufacturers of such goods can obtain further particulars from the Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Reference B.X. 5132.)

Henley's Overseas Activities.

Another indication of the ubiquity of W. T. Henley's Telegraph Works Co., Ltd., is provided by the photograph reproduced herewith. It shows a drum of cable loaded on a motor lorry for transport to the Agricultural Department at Aburi, Gold Coast. The garb of the native crew shows the influence of European civilisation to a marked degree.

Messrs. Turnbull & Jones, Ltd., electrical engineers and contractors, of Wellington, N.Z., have informed Messrs. Henley's that they have been responsible for the electrical reticulation of Palmerston North, an inland town approximately 89 miles from Wellington, with a population of round about 25,000. The work commenced in 1924.



Henley Cable on the Gold Coast.

In the aggregate there were used 392,970 yd. of "Henley" cables; 120 tons of bitumen; 364 various joint boxes; 37 terminal boxes; 8 manhole network boxes and 450 fuse boxes.

Among the important wiring installations carried out by Messrs. Turnbull & Jones during recent years may be mentioned "Henley Wiring System" fire-alarm installations in the General Post Office, Wellington, and the Auckland Public Library and Art Gallery, and installations with "Henley" cables and wires in the Wellington Grand Opera House; the National Bank of New Zealand, Auckland; the Auckland War Memorial Museum, the building cost of which was in the neighbourhood of £250,000; the Dunedin City Corporation's new gas retort house; and Knox College, Dunedin.

"Service in Salesmanship."

An address bearing the above title was delivered by Mr. E. L. Colston (Hoover, Ltd.) at a North-East Coast Area E.D.A. Conference at Newcastle on February 20th. Mr. V. A. Pask (Newcastle and District Electric Lighting Co., Ltd.) presided. Mr. Colston gave a number of widely-differing definitions of "service," and came to the conclusion that service was high-grade salesmanship. He went on to show that service could be rendered in many directions not all of which were directly connected with the sale of the goods, and pointed out that complaints provided excellent opportunities for business building. Service in salesmanship soon won a good reputation and a good reputation built up goodwill. The speaker advised the audience never to make misrepresentations or give promises which could not be fulfilled. A discussion followed the address.

The next conference of the series is to be held on March 20th, when Mr. R. Robson is to read a paper on "The Position of the North-East Coast in the Electrical Industry."

Bankruptcy Proceedings.

B. H. Wishaw, Bakewell Road, Matlock, Derbyshire, electrical and wireless engineer.—The adjourned public examination herein was held recently at the Court House, Derby. The previous hearing was adjourned to enable the debtor to file a cash account. He admitted now that he could not give all the details, but he stated that he had sufficient information on which to base a return. Being questioned with regard to an agent, who, he alleged, had failed to pay certain accounts with money entrusted to him for the purpose, the debtor stated that he knew nothing about the man except that he was recommended by a firm from whom the debtor purchased goods. The agent paid out only £63 out of £128 handed to him. He also agreed to guarantee the bills for further goods, but failed to meet the liability, with the result that the debtor had to find another £30. The examination was formally adjourned for closing, on the understanding that the debtor should file a cash account.

N. H. Wood, 32, Highbury Avenue, Thornton Heath, Surrey, lately of 38, St. Charles Square, North Kensington, W.10, electrical engineer.—An application for discharge was made by this debtor on February 21st at the County Court, Croydon. The receiving order was made in July, 1927. The statement of affairs showed liabilities estimated at £173 and assets estimated at £11, which had realised £18. In addition, the debtor had paid £16 out of his earnings. A first and final dividend of 1s. 10d. in the £ had been paid. A creditor had an objection to the discharge, and the judge adjourned the application generally with leave to apply.

H. D. Douglas (H. D. Douglas & Co.), engineer, wireless factor, &c., 32, Queen Victoria Street, E.C.—Bankrupt's discharge suspended for six months until July 30th, 1929.

C. K. Wallis, electrical engineer, Bedford Street and Longford Road, Bognor.—Last day for proofs for dividend, March 12th. Trustee, Mr. R. W. Cave, Official Receiver, 12a, Marlborough Place, Brighton.

T. F. Collier, electrician, 116, Union Street West, Oldham.—First and final dividend of 9s. 1d. in the £, payable at the Official Receiver's offices, Byrom Street, Manchester.

E. F. Lee (F. Newton), electrical engineer, 340a, Kings Road, Chelsea, S.W.—Receiving order made February 22nd on debtor's own petition. First meeting held March 6th; public examination, April 12th, both at Carey Street, W.C.

A. B. Gregory, wireless expert, 29, St. Albans Road, Seven Kings.—Application for discharge to be heard March 18th at the Shire Hall, Chelmsford.

T. F. J. Truss, electrical engineer, 28, Wincobank Avenue, Sheffield.—Receiving order made February 26th, on a creditor's petition.

T. C. Wheeler, electrician, 30, Stockton Street, West Hartlepool. Receiving order made February 25th on debtor's own petition.

L. H. Lawrence (H. F. Lawrence), electrical engineer, 43, Canterbury Road, Margate.—Trustee, Mr. C. S. Scarlett, 5, Cecil Square, Margate, appointed February 25th.

Company Liquidations.

Epoch Electrical Society, Ltd., late Gracechurch Street and Cannon Street, E.C., and Manchester.—The statutory meeting of creditors was held on February 28th, at the offices of Messrs. Linett, Hughes & Co., 24-25, Ironmonger Lane, E.C. Mr. C. Hughes, the liquidator of the company, occupied the chair, and submitted a statement of affairs which showed ranking liabilities of £2,059, and net assets of £323, leaving a deficiency of £1,736. The issued capital was £1,000, making a total deficiency of £2,736. The company was registered in September, 1927, with a nominal capital of £1,000, and the whole of the shares were issued for cash. The company started an entirely new business. Between September 6th, 1927, and February 9th last the turnover was £9,871, and there was a net loss of approximately £2,000. The company was forced to vacate its premises at an unfortunate moment, and the Christmas trade was interfered with. The Manchester shop was closed after a comparatively short period of trading. One of the directors admitted that a certain amount of price-cutting had possibly taken place. He said that when a man entered a shop to purchase a wireless set, he invariably asked for a discount. Practically speaking, no purchaser paid the full amount. A resolution was passed confirming the voluntary liquidation of the company with Mr. Hughes as liquidator, and an advisory committee was also appointed consisting of Messrs. C. Latham, of the Wireless and Radio Trades Guardian Association, A. Ball (Marconiphone Co., Ltd.), and R. A. Bishop (C. D. Dickeson & Sons, Ltd.). The following are creditors:—

	£		£
Marconiphone Co., Ltd.	142	Halcyon Wireless Co., Ltd.	42
Rolls-Caydon Sales, Ltd.	126	Oldham & Son, Ltd. ...	39
Philips Lamps, Ltd. ...	111	Quint, J.	31
Sun Electrical Co., Ltd.	105	Marconi's Wireless Telegraph Co., Ltd. ...	28
Dickeson, C. B., & Sons, Ltd.	96	London Metal Warehouses, Ltd.	24
Harris & Russell, Ltd.	87	Eastick, J. J., & Sons ...	21
Langham Radio Co. ...	26	Iliffe & Sons, Ltd. ...	98
East London Rubber Co.	51	Diggles & Ogden	81
Burndept Wireless (1928), Ltd.	50	Bernard Jones Publications, Ltd.	39
Brown, S. G., Ltd. ...	50	Arnott, R.	150
Mullard Wireless Service Co., Ltd.	44	Hurst, A.	291
McMichael, L., Ltd. ...	45		

A. I. Greenwood, Ltd., Guildford Street, Leeds, wireless and electrical dealers, &c.—The statutory meeting of creditors was held recently at the offices of Messrs. Emmerson, Armitage and Co., 99, Albion Street, Leeds. Mr. B. Armitage (liquidator) submitted a statement of affairs which showed that the assets were estimated to realise £3,494 (net) to meet debentures of £5,000. There was thus a deficiency as regarded the debentures of £1,506, and there were no assets available for the unsecured creditors whose claims aggregated £2,280. The ranking liabilities were set down at £3,786, with a deficiency of the same amount so far as the creditors were concerned. The deficiency as regarded the shareholders was £20,013. The company was registered in March, 1926, and it took over the business as from the previous November. The consideration for the sale of the business was the issue of shares of the face value of £6,000, and debentures for £5,000. The widow of the late proprietor was allotted the whole of the shares and the debentures. During the period to September, 1926, the turnover was £3,595, with a net loss of £2,140, and in the following year there was a net loss of £2,063, on sales of £27,795. During the year to September 30th, 1928, the sales were £19,350, with a net loss of £2,433. Since September 30th last, the sales had been £4,336, with a net loss of £1,176. It was pointed out that the statement showed that there would be no dividend for the creditors, and it was suggested that the debenture holder might be approached to see whether she would allow some portion of the assets to be distributed among the creditors. No definite resolution was passed, and the voluntary liquidation will therefore be continued with Mr. Armitage as liquidator. The following are creditors:—

	£		£
A.F.A. Accumulators ...	27	Page, A., & Sons, Ltd.	37
Chorlton Metal Co. ...	32	Philips Lamps, Ltd. ...	29
Collier, H., & Sons, Ltd.	214	Rothermel Corpn., Ltd.	22
Cossor, A. C., Ltd. ...	86	Stevens, A. J., & Co., Ltd.	453
Enfield Cycle Co., Ltd.	416	Siemens Bros. & Co., Ltd.	27
Humber, Ltd.	134	Sellers of Leeds	92
Houghton-Butcher, Ltd.	110	Veeco Cycle Manfg. Co., Ltd.	21
Hardman & Co., Ltd. ...	37	Emmerson, Armitage and Co.	47
Lucas, J., Ltd.	50		
Lassaure, Ltd.	25		
Nesper, Dr.	26		

Marpole & Frisby, Ltd., electrical engineers, 161, Wardour Street, W.—The statutory meeting of creditors was held on February 25th at the offices of Messrs. Gray, Stainforth and Co., 31, Lombard Street, E.C., when the chair was occupied by Mr. F. S. Wilks, the liquidator of the company. A statement of affairs submitted showed liabilities to unsecured creditors of £548, while £76 was due to preferential creditors and £250 to a debenture holder. The assets were put at £309. The liquidator stated that the company was formed in February, 1918, to take over the business previously carried on by Marpole & Frisby. The capital was £2,070, and the trading had been carried on with fluctuating results ever since. During the past few years, however, there had been a decline in the returns, and Mr. Frisby paid in £250, taking a debenture covering this sum. During the last few months the trade had fallen off very considerably. Three weeks ago three writs were issued, and he (the chairman) was appointed receiver and subsequently liquidator as well. The company had worked on a gross profit of about 10 per cent., which was altogether insufficient for a business of that kind. Profits had had to be cut, however, in order to meet competition. It was decided that the matter should be left in the hands of the existing liquidator. The following are creditors:—

	£		£
Imperial Lighting Co. ...	94	Wakefield & Co.	20
Kings Signs, Ltd. ...	125	Wood & Garling, Ltd. ...	40
Matthews Bros., Ltd. ...	24	Young & Wildsmith ...	31
Metro-Vick Supplies, Ltd.	25	Robins, Gore & Mercer...	52
Sampson, Thos.	25	Gray, Stainforth & Co....	31

County Electrical & Wireless Stores, Ltd.—First meetings of creditors and contributories March 8th at Carey Street, W.C.

Maldon Electric Works, Ltd.—A meeting of creditors was held at the office of the Liquidator, Mr. A. F. W. Lovell, 5, Great Winchester Street, E.C., on March 4th. (This notice is purely formal; all creditors have been or will be paid in full.)

Erith Electrical Co. (Barber & White), Ltd.—A meeting of members is called for March 28th at the offices of the Liquidator, 87-89, Aldgate High Street, E.C., to hear an account of the winding-up from the Liquidator, Mr. L. G. Darling.

Private Arrangements.

A. Rutherford, electrician, Plowman's Yard, Finchley, N.W.—A meeting of creditors was held on February 27th at the Law Society's Rooms, when a statement of affairs was presented by Messrs. Hereward Scott & Co., 133, High Street, N.16, which disclosed liabilities of £735, of which £662 was due to trade creditors. The net assets were £169, leaving a deficiency of £566. The debtor's solicitor stated that the business was commenced just after the war, and the present position had been brought about by the debtor recently incurring a bad debt of £143. The accountant stated that it was impossible to prepare any proper trading accounts, as the debtor's books had not been fully written up. An account prepared as at June 30th, 1928, showed that the stock at cost was £259, whilst there were debtors of £259. The liabilities to trade creditors at that time were £692. There was no offer to put before the meeting. Mr. W. A. J. Osborne, of Messrs. Corfield and Cripwell, was appointed to investigate the matter and report to a further meeting. The following are creditors:—

	£		£
Falk, Stadelmann & Co., Ltd.	209	Pope, H., & Sons, Ltd....	25
Metro - Vick Supplies, Ltd.	41	Wholesale Electric Lamp Co.	39
		Wood & Carling, Ltd. ...	231

Dissolutions of Partnership.

H. A. Jackson & Co., manufacturing electrical engineers and merchants, Caxton Hall, Chapel Street, Salford.—Messrs. J. A. Singleton (J. A. Jackson) and R. Ramsden have dissolved partnership. Mr. R. Ramsden will attend to debts and continue the business.

Central Garage, motor and electrical engineers, &c., Dunstable.—Mr. H. Eames and Mr. L. H. Mattey have dissolved partnership. Mr. Eames will attend to debts and continue the business under the same style.

Trade Announcements.

Mr. E. Fieber having retired, the business of Messrs. E. Fieber & Son, 310a-312a, Euston Road, N.W.1, has been taken over by the Euston Electrical Supplies, at the same address, the directors being Capt. N. A. L. Stilling and Mr. V. Osborne. Mr. A. J. Moore will continue to act as sales manager.

The Alton Battery Co., Ltd., has appointed Mr. Joseph Rea, York Buildings, 32, Ann Street, Belfast, as agent for "Alton" stationary batteries for Ulster and County Donegal.

Electric Cables, Ltd., announces that as Mr. E. Marples has retired on account of ill-health, it has appointed Mr. H. Horsburgh, 61, Great Charles Street, Birmingham, as its agent for the Midland counties.

Messrs. Davis Bros. & Co. have opened an office and showrooms at 13, St. Martin's Court, Charing Cross Road, W.C.2, to deal with stage-lighting and illuminating work.

The telephone number of the City Electrical Co., Emerald Street, W.C.1, is now Holborn 9722 (4 lines).

Mr. William Taylor, electrician, has opened premises at Millstone Yard, Peel Street, Barnsley.

Electric Motor Supplies, Ltd., has moved to John Street, Huddersfield (Telephone No. 1966), where a larger showroom and bigger stocks have been arranged.

The British Secheron Co., Ltd., has moved to new offices and works at 158, Stonhouse Street, S.W.4. (Telephone: Battersea 3852; telegrams: "Brisecolim, Clapcom, London.")

The British Aluminium Co., Ltd., has opened a new branch office and warehouse at 66, Kirkstall Road, Leeds, under the management of Mr. C. F. Batstone. (Telephone: Leeds 23343; telegrams: "Aluminium Leeds.")

The head office of Messrs. Berry, Wiggins & Co., Ltd., is now at Tensulam House, Water Lane, Stratford, E.15. Their telephone number is unchanged.

The Electrified Mumbles Railway.

The new service of electric trains on the Mumbles Railway was commenced on March 2nd. There was no formal inauguration ceremony, but a souvenir booklet was prepared for the occasion. We have received a copy of this booklet, which contains an illustrated history of the railway, which is claimed to be the oldest in the world, four prior concerns having long gone out of existence. The Oystermouth Railway or Tramroad Company Act was placed upon the Statute Book in 1804, and the line has been operating ever since its construction. Horses were employed up to 1877, when steam traction was adopted.

Unemployment.

There was an increase of 115,500 in the number of registered unemployed during the week ended February 18th. The total at that date was 1,458,000, as compared with 1,342,500 on February 11th, and with 1,136,687 on February 20th, 1928. The large increase is attributed to the stopping of work by the recent severe weather.

New Catalogues and Lists.

Messrs. B. & F. Carter & Co., Lark Works, Rochdale.—An illustrated catalogue of cable-braiding machines of various patterns for many classes of cable.

Messrs. G. P. Dennis, Ltd., 66, South John Street, Liverpool.—Two illustrated price-lists giving particulars of "Desco" self-aligning, porcelain-handle fuses.

Ringsdorff Carbons (England), Ltd., Colindale Avenue, Hendon, N.W.9.—Two technical publications dealing with the company's carbon brushes, &c. Illustrated.

Tungsram Electric Lamp Works (Gt. Britain), Ltd., 72, Oxford Street, W.1.—A coloured pamphlet (priced) advertising the company's "Pearl" lamps, gasfilled and vacuum.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—A folder produced on novel lines advertising the company's electric signs of various patterns. Prices are given.

Messrs. Landis & Gyr, Ltd., Victoria Road, North Acton, W.3.—An illustrated pamphlet describing the company's instrument transformers.

The Ray Manufacturing Co., 25b, High Street, Wimbledon, S.W.19.—Circular letters advertising the "Andy" fuse wire carrier, with prices.

Pope's Electric Lamp Co., Ltd., 5, Arthur Street, New Oxford Street, W.C.2.—A comprehensive illustrated and priced catalogue of "Elasta" electric lamps.

Lighting Trades, Ltd., 30-31, Farringdon Road, E.C.4.—A well-illustrated catalogue of the company's "Redot" electric fires, cookers, boiling rings, kettles and other domestic appliances. Priced.

B.E.N. Patents, Ltd., 92, Tottenham Court Road, W.1.—An illustrated booklet describing the company's spray-painting and tire-inflating unit.

March calendar-blotters have been received from Pope's Electric Lamp Co., Ltd., 5, Arthur Street, W.C.2; Messrs. S. Rogers & Co., Ltd., 15, Fitzroy Street, W.1; Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow; and Messrs. Warren Bros. (Middlesbrough), Ltd., 91 & 93, Grange Road, Middlesbrough.

The A.E.G. Electric Co., Ltd., 131, Victoria Street, S.W.1.—Two illustrated pamphlets dealing respectively with electric fires and small domestic electrical appliances—tea kettles, percolators, irons, &c.

Lectro Linx, Ltd., 254, Vauxhall Bridge Road, S.W.1.—Illustrated price lists of the company's radio plugs and sockets, &c.

The Harland Engineering Co., Ltd., Alloa, Scotland.—Publication No. X56/2810, containing illustrated notes on the design, construction, installation and operation of "Harland" rotary convertors, from 50 to 2,000 kW.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, W.1.—March price list of electrical materials, accessories, and appliances. Illustrated.

Straight-Lite Reflectors, Ltd., 9-15, Oxford Street, W.1.—A blotter advertising the company's reflectors for showcase, shop-window, and cornice lighting.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.—Two price lists dealing respectively with "Vicma" and "Vinazo" wires and cables, and tough rubber sheathed cables.

Wireless Pictures (1928), Ltd., 14-16, Regent Street, S.W.1.—Three illustrated and priced leaflets, giving full particulars of the component parts necessary for the construction of the "Fultograph" picture receiver.

J. G. Statter & Co., Queen Anne's Chambers, Westminster, S.W.1.—Leaflet No. X220, describing the makers' totally enclosed, industrial-type, ironclad oil switches for wall or pedestal mounting.

The Midland Electric Manufacturing Co., Ltd., Barford Street, Birmingham.—A folder containing illustrations and brief descriptions of "Memset" switch-fuse units for house services.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—A well-produced catalogue of the company's accessories, including switch- and fuse-gear, plugs and sockets, cable sealing ends, &c. Each item is illustrated and dimensioned, and a thumb-index is provided.

Messrs. C. A. Vandervell & Co., Ltd., Acton, W.3.—A pamphlet illustrating and describing a window display for the use of the company's battery service agents.

Italian Lamp Production.

The output of electric lamps in Italy during September last amounted to 1,212,833, bringing up the total for the first nine months of 1928 to 11,054,324 lamps, as compared with 10,486,212 in the corresponding period of 1927.

German Electrical Imports.

The imports of electrical machinery, instruments, apparatus, &c., into Germany during last year attained a value of £2,281,750, as compared with £1,673,100 in 1927. The exports of similar material of German manufacture amounted during 1928 to £24,434,450, as compared with £19,935,800 in the preceding twelve months. Some details of German foreign electrical trade in 1927 and 1928 appeared in our last issue (p. 403).

New French Company.

La Société d'Installation de Force et de Traction (S.I.F.T.) is the name of a company which has lately been formed in Paris (10, Rue Caumartin) with a capital of one million francs to carry on business as electrical engineers.

Proposed German Government Holding Company.

The Prussian Government is considering the question of authorising the formation of a company with a capital of nine millions sterling to be known as the Prussian Electricity and Mining Company, to act as a holding company of the shares held by the Government in a number of electricity supply and mining undertakings in Prussia.

For Sale.

Erith U.D.C. Electricity and Tramways Committee has for disposal one 1,000-kW turbo-alternator with surface condenser and auxiliaries, also one 3-ton self-tipping Yorkshire steam wagon; Southampton Corporation Electricity Committee invites offers for one Cole, Marchent and Morley vertical triple expansion steam engine with surface condenser, &c., direct-coupled to a 1,000-kW Dick, Kerr d.c. generator; Basingstoke Corporation Electricity Department has for disposal one motor booster set with switchgear. Blackburn Corporation Electricity Department has for disposal a number of second-hand d.c. motors. St. Helens Corporation Tramways Department invite offers for a G.E.C. motor-generator. Sheffield Corporation Water Works Department has for disposal surplus generating and power plant. Guildford Corporation Sanitary Committee invite offers for one 2½-ton electric tipping lorry by Electricars, Ltd., with Edison battery. (See our advertisement pages to-day.)

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.		Price Mar 5.	Fortnight's inc or dec.
a	Acid, Oxalic	per lb.	5¾d.	...
a	Ammoniac, Sal	per ton.	£60	...
a	Ammonia, Muriate (large crystal)	,,	£62	...
a	Bisulphide of Carbon	,,	...	...
a	Borax	,,	£25	...
a	Copper Sulphate	,,	£25 10s.	...
a	Potash, Chlorate	per lb.	3½d. to 4d.	...
a	,, Perchlorate	,,	5½d.	...
a	Shellac	per cwt.	£13 10s.	...
a	Sulphur, Commercial	,,	£11	...
a	,, Roll	,,	£11	...
a	Soda, Chlorate	per lb.	3d.	...
a	,, Crystals	per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ...	per lb.	3¾d.	...
	METALS, &c.			
b	Aluminium, Ingots	per ton.	£95 to £100	...
b	,, Wire	per lb.	1/1 to 1/9	...
b	,, Sheet	,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—			
	Grade I	per ton net.	£200	£3 dec.
	Grade II	,, ,,	£183	£2 dec.
	Grade III	,, ,,	£75	£1 dec.
c	Brass (rolled metal 2" to 12" basis)	per lb.	11½d.	½d. inc.
c	,, Tubes (solid drawn)	,,	1/1½ to 1/1½d.	½d. inc.
c	,, Wire, basis	,,	11¾d.	½d. inc.
c	Copper Tubes (solid drawn) ...	,,	1/3½	½d. inc.
c	,, Bars (best selected) ...	per ton.	£116	£8 inc.
c	,, Sheet	,,	£116	£8 inc.
c	,, Rod	,,	£116	£8 inc.
d	,, (Electrolytic) Bars ...	,,	£91 10s.	£7 inc.
d	,, ,, Sheets ...	,,	£143 10s.	...
d	,, ,, Wire Rods	,,	£101 10s.	£7 inc.
d	,, ,, H.C. Wire	per lb.	1/0⅞	⅛d. inc.
f	Ebonite Rod	,,	2/8 to 2/8	...
f	,, Sheet	,,	2/8 to 2/8	...
m	German Silver Wire	,,	2/2	...
h	Gutta-percha, fine	,,	nom.	...
h	India rubber, Para fine	,,	1/1⅛	½d. inc.
l	Iron Pig (Cleveland No. 3.) ...	per ton.	80/-	...
l	,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g	Lead, English pig	,,	£25	10/- inc.
g	Mercury	per bot.	£22 2s. 6d. to £22 5s.	...
e	Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e	,, ,, medium	,,	4/- to 8/-	...
e	,, ,, large ...	,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings	,,	1/3½	...
p	,, ,, drawn bars & rods	,,	1/3½	...
p	,, ,, rolled strip & sheet	,,	1/3½	...
p	,, ,, wire...	,,	1 6	½d. inc.
o	Platinum	per oz.	£13 17s. 6d.	...
d	Silicium Bronze Wire	per lb.	1/1	...
r	Steel, Magnet, in bars	,,	7½d.	...
n	Tin, Block (English)	per ton.	£219 10s. to £220	£3 dec.
n	,, Wire, Nos. 1 to 16	per lb.	8/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
m P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
W. F. Dennis & Co.

Reporting on March 2nd, Messrs. James Forster & Co. stated that the feature of the lead market had been extensive covering of sales of Mexican lead for delivery this month. But for this prices would probably have been lower, as the demand from home consumers has quietened down considerably this week, while the Continent has again done little. The position of supply and demand appears to be very well balanced but for the moment prices seem high enough, though no appreciable set-back should be seen.

The South African-German Trade Treaty.

On March 1st the South African House of Assembly approved the conclusion of a commercial treaty between the Union and Germany by 62 votes to 51. General Hertzog, in reply to protests from the Opposition, said that it was unnecessary to transmit the motion to the Senate for approval; the lower House alone was competent to ratify the treaty.

Belgian Enterprise in Central Europe.

It is reported in Brussels that the recently-established Belgian electrical trust, "Elektrobel," has been negotiating successfully for participation in certain Czecho-Slovakian supply organisations. The "Hydrofina" is extending its operations in Rumania and proposes to develop the Argesu water power resources.

New German Company.

With the title of the Westdeutsche Elektricitätswirthschaft Gesellschaft, a company has been formed in Frankfurt-am-Main with a capital of £50,000. The undertaking has been formed by a number of the principal electricity supply companies in west and south-west Germany with the object of centralising the sale of power through a single concern.

New Belgian Company.

Among the companies recently formed in Belgium is the Compagnie Italo-Belge pour Entreprises d'Electricité et d'Utilité Publique, Brussels, capital 5 million francs, to engage in electricity supply enterprises in Italy.

Polish Foreign Electrical Trade.

The *Board of Trade Journal* shows that during December last Poland imported "apparatus, conductors and other electro-technical materials" valued at 7,319,000 zloty (about £1,000). Polish exports of this class of goods had a value of 44,000 zloty (about £1,000).

Lighting and Power Notes.

Australia.—Launceston (Tasmania).—The report of the city electrical engineer (Mr. R. J. Strike) on the working of the electricity undertaking for the year ended June 30th last records a total income of £76,830, as compared with £69,193 in the preceding year. Working expenses amounted to £48,564, as against £47,766, leaving a gross profit of £28,266 (£21,427). After providing for capital charges there was a net surplus of £4,481, as compared with a loss of £7,712 in 1926-27. The electrical energy sold totalled 9,119,707 kWh, an increase of 1,377,328 kWh, and the maximum load recorded 3,952 kW, an increase of 475 kW.

Canada.—Electrical Development.—The Hydro-Electric Power Commission of Ontario has approved the duplication of the 220-kV transmission line, from the Toronto Leaside transformer station to the Ottawa River at a cost of approximately $3,000,000. The work will be carried out as previously by the Commission's own construction staff. The Commission plans to proceed with the westerly half of the line during the coming summer, with towers of similar design to the existing towers, with the expectation of having this half available to connect with the present line for the second increment of Gatineau power. The construction of the easterly half of the line will follow, so that the entire new line will be available by the autumn of 1930, when the third increment of power from the Gatineau will be supplied. Last year the Commission authorised the connection of a double-circuit 110-kV transmission line from Pelham Junction to St. Thomas transformer station. Authority has now been given to connect the terminus of this line, which is at present under construction, for 10 miles in an easterly direction, at an estimated cost of $180,000.

The Gatineau Power Company, controlled by the Canadian Hydro-Electric Corporation, Limited, a subsidiary of the International Paper and Power Company, has started up additional generators in its Farmers and Chelsea hydro-electric plants on the Gatineau River. The two new generators with a combined capacity of 58,000 h.p., raise the total installed capacity of the Farmers and Chelsea plants to 232,000 h.p. The total capacity of the plants of Gatineau Power Company is now 562 600 h.p. installed and in process of installation. Of this, 439,000 h.p. is on the Gatineau River, and the balance is in the hydro-electric developments of the company on the Ottawa River and its other tributaries. In 1928, the company produced 1,286,000,000 kWh.

Continental.—Czecho-Slovakia.—The West Moravian Electric Power Supply Co. is establishing a new steam-operated electric power station at Brunn which will be equipped with two 4,500-kW high-pressure turbines and two low-pressure sets—one of 9,000 kW and one of 6,000 kW capacity. The

high-pressure sets will operate with steam at a pressure of 65 atmospheres superheated to 450 deg. C. The plant will be interesting in that the exhaust steam from these machines will be conveyed by piping for the operation of engines and for heating purposes in the local textile mills.

GERMANY.—Statistics published in *Wirtschaft und Statistik* show that the production of electricity in Germany during 1927 amounted to 25,100 million kWh, an increase of 3,900 millions, as compared with the preceding year, representing an increase by 52 to 392 kWh per head of the population. New plant installed during the year raised the capacity to 10,000,000 kW. The energy derived from solid fuel was 72 per cent. of the total production, and water power accounted for 15 per cent., a decrease of 1 per cent.

Dover.—LOAN.—The Corporation Electricity Committee has recommended that application be made for sanction to a further loan of £3,000 for services.

Guatemala.—NEW POWER STATION.—An electrical plant, known as Santa Maria, and one of the largest in Guatemala, is about to be opened to supply power to the Ferrocarril Los Altos (San Felipe-Quezaltenango), which will use 9,000 of the 10,000 h.p. generated, the rest being used at Quezaltenango, 60 miles away. A second plant has been completed at Huehuetenango, 75 miles from Quezaltenango.—*Reuter's Trade Service* (Guatemala City).

Guildford.—EXTENSION OF SUPPLY.—At a recent meeting of the Corporation Electricity Committee, the borough electrical engineer reported that there was a large number of residents in the Shamley Green, Lords Hill, Blackheath, and Chilworth districts waiting for supplies of electricity. Before supplies could be given it would be necessary to erect transformer kiosks and lay l.p. cables at a cost of £4,954. He estimated the return on the completion of the extensions at £1,400 per annum. The extensions were approved.

Hull.—BULK SUPPLY TO TRAMWAYS.—The Corporation Electricity Committee has authorised the borough electrical engineer to take steps to supply electricity in bulk to the tramway undertaking. The estimated cost of the scheme is £35,000, and it has been approved by the Tramways Committee in preference to renewing the plant at the tramway power station, which would cost £42,000.

Lancaster.—NEW PLANT.—The Town Council has approved of a recommendation to extend the Caton Road generating station by installing a battery, booster, and switchgear at an estimated cost of £7,000. This plant is required to work the auxiliary engines for lighting.

Leicester.—INSTITUTION SUPPLY.—The Corporation Health Committee reports that at the present time electricity for the isolation hospital and sanatorium is obtained from the Corporation mains, and the cost to the Committee for electricity during the past year has been over £1,000. The Committee has been advised that it is possible to generate electricity at the hospital from the waste heat from the various reducing valves at a cost of 0.366d. per kWh, as against that paid of 2.303d. per kWh. With this in view, the Committee intends to install two 75-kW generating sets, together with the necessary switchgear, &c., at an estimated cost of £1,802. This will meet all present demands, and also allow for some proposed extensions.

Liverpool.—NEW POWER STATION.—The Corporation has set up a special committee to take in hand the construction of the Clarence Dock power station, which it is estimated will cost £1,764,000. This station will include plant with a capacity of 100,000 kW in two 50,000-kW sets. Contracts are to be invited for the buildings and plant.

Llanidloes.—ELECTRICITY SUPPLY.—At a recent meeting of the Town Council a letter was received from the Llanidloes Electric Light Co. stating that circumstances had arisen which made it necessary for the company to remove its generating plant to some other premises, and it inquired whether the Corporation desired to acquire the undertaking. The matter was referred to the Lighting Committee for consideration.

London.—BATTERSEA.—The Borough Council Electricity Committee is to extend mains from Park Road, Battersea Bridge Road, to the premises of Hovis, Ltd., Anhalt Road, and provide transformers and switchgear at a cost of £3,737. The Committee has decided to convert lamps in further streets from gas to electricity, at a cost of £1,468.

HAMMERSMITH.—The Borough Council Electricity Committee has recommended the following reductions in the charges for electricity:—General lighting: ordinary meters—maximum price from 4d. to 3½d. per kWh; pre-payment meters—from 4½d. to 3½d. per kWh. General power: from 1½d. to 1½d. per kWh. Tariff (A): from 1½d. to 1½d. per kWh. Tariff (B): from 1.15d. and 0.9d. to 1.05d. and 0.85d. per kWh. Tariff (C): from 1d. and 0.75d. to 0.98d. and 0.73d. per kWh. Tariff (D): Ratable value charge from 10 per cent. to 7½ per cent., kW charge from £8 to £6, and "unit" charge from 1d. to ¾d. Tariff (E): electricity consumed between 9 p.m. and 6 a.m.—from ¾d. to ½d. per kWh. The reductions are equivalent to an estimated revenue of £22,572.

Northern Ireland.—PORTRUSH.—The Urban District Council is to apply to the Electricity Commissioners for sanction to borrow £4,200 to meet expenditure on additional plant.

Palestine.—THE RUTENBERG SCHEME.—*The Times* reports that another eight months should see the completion of the work on the dams, canal and bridges of the Rutenberg scheme for harnessing the Jordan for the electrification and irrigation of Palestine, work on which was commenced early in 1928. By the beginning of this year, the Yarmuk dam was nearly completed, and the head-race canal had been excavated and filled, so that it only waits for the rainy season to be lined with concrete. The excavation of the Jordan-Yarmuk canal is proceeding, and the building of the dam across the Jordan will begin soon. At the end of the eight months Haifa should be supplied with hydro-electric power from the Jordan. Soon after power will be carried by h.p. lines to Jaffa and district. Then all but Jerusalem will be supplied with electricity from the Jordan. A British company has the rights of a pre-War concession for the lighting of the latter city. The Jordan power house will consist of three 8,000-h.p. turbo-generators at first, and a fourth is to be added later, when definite data on the amount of water available have been obtained. This power house will at first use the unregulated waters of the River Yarmuk, supplementing them, especially in summer, by required amounts of the Jordan water stored in Lake Tiberias. The second power house at Abadieh will be erected when the demand for power rises to the maximum capacity of the first. Both will then be using all the waters of the Jordan and Yarmuk, drawn together through Lake Tiberias. If necessary a third power house will be built to the north of Lake Tiberias, utilising the fall of 200 metres in the Jordan between Lakes Meron and Tiberias.

Perth.—ELECTRICITY IN BULK.—The Corporation Electricity Committee has considered correspondence with the Grampian Electricity Supply Company with regard to obtaining a bulk supply of electricity from the company, and a sub-committee is to inquire and report.

Prestatyn.—LOAN.—The Urban District Council is applying for sanction to a loan of £10,000 for mains, services, and meters.

South Africa.—JOHANNESBURG.—Satisfactory progress is being maintained in connection with the installation of the 10,000-kW turbo-generator at the new power station of the City Council. The main building has been completed, and the transformers, switchgear, and cooling towers have been installed. The coal-handling plant and railway siding are almost finished. Four new boilers are to be installed, and the total cost is expected to exceed £500,000.

PIETERSBURG.—The Municipal Council has adopted a report from its consulting engineer (Mr. A. E. Val Davies) regarding the further development of the electricity undertaking. The Council is to erect a new power station which will contain two boilers operating at 200 lb. and 550 deg. F., together with an economiser and two new 150-kW alternators, and one 150-kW set to be transferred from the existing station. The total cost of the scheme, including cables and sub-stations and the changing of the voltage to 220/380 is estimated at £24,765.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Electric Supply Corporation, Ltd., authorising the transfer of the undertaking authorised by the Exmouth Electricity Special Order, 1923, and the powers granted under this Order to a company registered or to be registered; the West Hampshire Electricity Co., Ltd., to supply electricity in the rural districts of Alresford and Droxford, and part of the rural district of Winchester; the Mersey Power Co., Ltd., to supply in part of the parish of Weston; and Colne Corporation, to supply electricity in the urban district of Trawden.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Electricity Company of Macclesfield, Ltd., to supply electricity in the urban district of Bollington and part of the rural district of Macclesfield.

The following Special Orders made by the Commissioners have been confirmed by the Minister of Transport: Glaslyn and Deudraeth Rural Districts Electricity Special Order, 1929 (undertakers: Gwynedd Trust, Ltd.); Tonbridge Electricity (Extension) Special Order (Tonbridge Urban District Council); North Somerset Electricity (Extension) Special Order (North Somerset Electric Supply Co., Ltd.); and Brentwood and District Electricity (Extension, &c.) Special Order (Brentwood and District Electric Co., Ltd.).

Stoke-on-Trent.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to loans of £13,000 for overhead lines and £5,000 for transformer, switchgear, and metering equipment.

Torquay.—INQUIRY DECISION.—At a meeting of the Electricity Committee, the town clerk reported that the Electricity Commissioners, after careful consideration of the evidence given at the inquiry held at Torquay, had decided to refuse the application of the Teignmouth Electric Lighting Company, Ltd., and to grant the application of the Corporation on the following terms and conditions, *viz.*, the necessary steps to be taken by the Corporation to include the parish of Widecombe-in-the-Moor within the proposed area of supply; the non-statutory undertaking in the urban district of Buckfastleigh to be purchased from the Teignmouth Company on terms to be agreed between the parties or failing agreement to be determined by arbitration; and the maximum price scheduled to the Torquay order to be reduced from 1s. to 10d. per kWh with minimum quarterly charges on the usual basis.

Trowbridge.—Overhead Lines.—As an outcome of an inquiry held in January last, the Ministry of Transport has allowed the appeal of the West Wilts Electric Light & Power Co. against the decision of the Urban District Council requiring the use of steel poles for the overhead lines in Gloucester Road and Wesley Road. The company will therefore be empowered to use wooden poles.

Wing.—Electricity Supply.—The Rural District Council has decided to approach the Luton Town Council with the object of obtaining a supply of electricity for the Ivinghoe district from the h.p. transmission line to be erected between Cheddington and Ivinghoe to Aylesbury.

Tramway and Railway Notes.

Acton.—Tramway Scheme.—The Middlesex County Council has reported that it obtained powers in 1925 to construct a connecting link of tramway to enable the Metropolitan Electric Tramways to connect up with the London United Tramways at Horn Lane, Acton. The proposed route of the connecting link is The Steyne and Rectory Road, Acton, and negotiations have been conducted with the Metropolitan Electric Tramways Co., with the object of ascertaining whether it is prepared to include this new tramway link in the system. The company has intimated that before agreeing to operate the new tramway, it desires to know whether it is the County Council's intention to charge against the tramway undertaking the expenditure which will be incurred in the necessary road widenings. The Council is of opinion that no charge in respect of acquisitions should be debited to the cost of the tramway scheme.

Australia.—Launceston (Tasmania).—The report on the working of the city tramway undertaking (superintendent: Mr. R. J. Strike) for the year ended June 30th last shows a total revenue of £49,946, and working expenses of £35,979, leaving a gross profit of £13,967. The figures for the preceding year were: Income, £51,342; working expenses, £39,648; gross profit, £11,694. Capital charges absorbed £8,922, and there was a net surplus of £5,045, as compared with £2,608 in the previous year. The number of passengers carried increased by 224,879 to 4,720,083, and the car-miles run by 3,265 to 472,970. The revenue per car-mile rose from 22.372d. to 22.668d.

Blackburn.—Penny Fares.—The Corporation has again approved penny fares on several routes in the borough. The system was given an experimental trial some time ago and discontinued on account of loss of revenue.

Croydon.—Tramcar Improvements.—Having regard to the increased receipts from top-covered tramcars the Corporation Tramways Committee has recommended the reconditioning and covering of nine further cars at a cost of £4,000.

Japan.—Electric Railways.—The survey of the Koriyama-Yumoto electric railway has been completed and application has been made for permission to commence the work of construction. The railway will be constructed between Koriyama station on the Government North-Eastern Line and Yumoto-machi, a distance of approximately 27 miles.

The Hankyu, Hanshin and Keihan Electric Railway Co., has in hand a scheme for the construction of a rapid transit electric railway between Osaka and Miyazu, a distance of 67 miles. The distance will be covered in about two hours, as compared with 2½ hours now taken by the Government service.

Lincoln.—Abandonment of Tramway.—The Corporation tramway service was abandoned on March 4th, and motor-omnibuses have been introduced.

Mexico.—Railway Electrification.—The Mexican Railway Co. has electrified a further 30 km. of its line between Cordoba and Paso del Macho, making a total of 103 km. electrically operated. A second sub-station with two 1,500-kVA synchronous motor-generators has been installed at Potrero.

Rothesay.—Abandonment of Tramway.—Application has been made to the Secretary of State for Scotland by the Rothesay Tramways Co., Ltd., for an Order enabling it to make provision for a temporary discontinuance, and ultimately the abandonment of its tramway. The company proposes to substitute motor omnibuses for the existing tramway service.

South Africa.—Railway Electrification Cost.—The *South African Engineer* reports that the Auditor-General gives the following figures regarding the cost of electrifying the Glencoe-Maritzburg section of the Natal railway system. Excluding the cost of electric locomotives, the total expenditure on the electrification of the 170 miles, including the Howick branch, to March 31st, 1928, was £4,473,811. Adding £1,160,959 as the expenditure on the electric locomotives to the same date, the total cost was £5,634,771. Further expenditure has to be incurred owing to damage by electrolysis to the concrete mast foundations. This, the Auditor-General states, is estimated at £20,350, of which £10,350 will be spent on preventive measures.

Southern Railway.—Progress During 1928.—The report of the Southern Railway Co., for the past year, states that the colour light signalling already introduced in the London area has proved very efficient and the system has been installed on the lines between London Bridge station and Bricklayers' Arms Junction. In March last a further stage of the electrification scheme, comprising the equipment of the lines from London Bridge to Tattenham Corner and Caterham and the line from Sydenham to Norwood Junction *via* Crystal Palace was completed. Another section from London Bridge to Sutton and Epsom Downs, Victoria to Peckham Rye, Tulse Hill to Crystal Palace and Streatham Hill, was brought into use in June last. A further stage was expected to be ready for use in March, comprising the following lines: Victoria to Mitcham Junction, Sutton and Epsom; Herne Hill to Tulse Hill; Streatham to Wimbledon; and Crystal Palace to Beckenham Junction. (Electrified services on these routes were put into operation on March 3rd and 4th.) It is anticipated that by the end of this year the a.c. system adopted on the L.B. & S.C. lines in 1909, will be entirely superseded by the system of d.c. working, thereby standardising the method of traction throughout the company's electrified area. The capital expenditure during the year amounted to £1,079,145, of which £8,900 was for electrification of suburban lines, and £106,118 for electrical equipment of trains. Estimates of further capital expenditure include £215,000 for electrification of suburban lines, and £60,000 for electrical equipment of trains.

Swansea.—Mumbles Railway.—The electrification of the Mumbles Railway has been completed, and a service of electric trains commenced on March 2nd. Power for the railway is supplied from Swansea Corporation power station, and a sub-station has been erected at Blackpill for this purpose.

Tottenham.—Tramway Scheme.—The Middlesex County Council Highways Committee, reporting upon the present position of the scheme for widening and reconstructing Broad Lane and Ferry Lane, Tottenham, and also upon the proposal for the construction of a new light railway, states that steps should now be taken for the necessary powers. The Metropolitan Electric Tramways, Ltd., has agreed to take over a new lease of this light railway at an annual rental of £4,000 provided the County Council refunds the amount already expended by the company (approximately £36,000) for the purposes of the light railways authorised by the Tottenham and Walthamstow Light Railways Order, 1906.

Telegraph and Telephone Notes.

Canada.—Wireless Communication.—The terms of the agreement between Canada, the United States, Newfoundland, and other North American countries in connection with the assignment of frequencies in order to control the wireless band throughout the Continent have been announced, the agreement being the result of the International Conference held at Ottawa in January last. The part of the agreement dealing with commercial wireless services gives Canada and Newfoundland 103 general communication channels, compared with 146 for the United States, 20 for Cuba, and 24 for other North American countries. The agreement came into force on March 2nd for three years. The division of wireless channels between Canada and the United States is satisfactory to the Canadian authorities.—*Reuter* (Ottawa).

Czecho-Slovakia.—Radio Station.—The Czecho-Slovakian telegraph authorities have recently placed a contract with the Telefunken Gesellschaft, of Berlin, for the establishment and equipment of a short-wave wireless telegraphy station at Podeprady, near Prague.

Sardinia.—Telephone Communication.—It is reported from Milan (Italy) that the Minister of Communications has ordered preparations to be made for the laying of a submarine telephone cable to Sardinia. Wireless telephone communication is also to be established with the island.—*Reuter's Trade Service* (Milan).

South Africa.—Railway Telephone Development.—In his annual report for 1928 the general manager of the South African Railways and Harbours stated that a comprehensive telephone construction programme had been adopted to improve communication over the system. A sum of £200,000 is to be spent during the next three years, and the work provided for in the first year's programme is in hand.

The Telephone Service.—North Wales.—The annual progress report for 1928 relative to the Chester, North Wales and Hanley district (superintending engineer: Mr. R. A. Weaver, M.I.E.E.) indicates that the net addition to the number of telephones was 2,584, or 7.5 per cent., the total number being 37,187. In rural areas 6 exchanges were opened, and 7 others are to be opened; 3 automatic exchanges were

opened, and others are in course of construction, while one new manual exchange was inaugurated and the extension of others added 1,965 subscribers' lines. During the year 1,262 miles of wire was brought into use for trunks and telegraphs, and 14,523 miles for subscribers' telephones, making a grand total of 124,295 miles of underground wires. Overhead wires for trunk and local services amounted to 2,041 miles, bringing the total up to 65,501 miles, an increase of 3.2 per cent.; the increase in underground wires was 1,262 miles for main lines and 14,523 for subscribers. Public kiosks increased by 43 to 82. The number of effective trunk calls increased to 3,898,971, an increase of 5.4 per cent. Telegrams passed over the telephone lines totalled 315,124, an increase of 6.3 per cent. The total local and junction calls originated was 15,670,278, an increase of 3.3 per cent.

New London Exchanges.—Nine new exchanges were added to the Greater London telephone area last week, a "record." Archway Exchange took over subscribers in the Highgate district, Emberbrook relieved the pressure in the rapidly-growing Kingston area. Flaxman took over part of Kensington, and Hillside part of Finchley; Metropolitan received its first subscribers by a transfer from London Wall, and National was brought into existence to cope with the ever-growing traffic in the City. These six new exchanges, together with Pollards in Norbury, and Valentine in Ilford, are at present being operated as manual exchanges, but Archway will be transferred to the automatic system on March 9th. The ninth new exchange is Temple Bar, which was opened on March 2nd, and is automatic. The total number of exchanges in Greater London is now 138, as compared with 120 a year ago. In the same period the number of telephones in the Greater London area has increased from 555,592 at the end of January, 1928, to 604,349, the latest official figure available.

Fire.—The Post Office Telephone Department accomplished in 48 hours the task of installing at Llandudno complete manual telephone plant as a temporary substitute for the automatic system which was recently put out of action by fire.

Transatlantic Telephony.—Proposed Cable.—So greatly has the use of the transatlantic wireless telephone service increased and so overloaded are the present facilities that the American Telephone and Telegraph Company has decided to spend much money on laying a special submarine telephone cable across the Atlantic Ocean. This fact emerges from the annual report of the company issued on March 1st, which states that the stockholders number over half a million, while approximately 20,000,000 telephones are now in use in the United States. Last year the company spent 400,000,000 dollars on extending its services and on reconstruction work.—*Reuter's* (New York).

United States.—Ford Radio Stations.—The Radio Commission has refused the application of the Ford Company for construction permits and commercial licences for six stations by means of which it desires to establish communication between its plant at Dearborn, near Detroit, and its rubber plantations in Brazil.—*Reuter* (Washington).

Radio Notes.

B.B.C. Problems.—Reproduction.—Some problems of broadcasting were touched upon by Mr. David Curd, engineer-in-charge of the Plymouth station of the B.B.C., in an address before the Plymouth Rotary Club on February 22nd. The handling of frequencies was one of the most important things in broadcasting. The results were transmitted quite true, and they gave listeners the various harmonics of a person's voice. They put those tones on the line, but most of them were cut off and sometimes all the little harmonics lost by the receiver at the other end. He deplored the fact that the correction, or "tone sauce," supplied by the engineer often lost its effect owing to listeners' sets. They could never persuade the public that they did transmit pure music, and he argued that in all large towns there ought to be a salon, or some sort of parlour, where people could be taken to listen to radio broadcasting as it really was. Mr. Curd advised listeners who were seriously concerned with the reception of music to study the improvement of the acoustics of their rooms. Little re-arrangements like hanging a curtain, or taking one down, or shifting some of the furniture, very often made a tremendous improvement in reception. If listeners, instead of trying to get anything from long-distant foreign stations, would concentrate upon true production from their nearest station, they would get more enjoyment for their money.

International Radio-telephony.—Geneva Principles.—The Juridical Committee of the International Union of Radiophony has laid down a number of guiding principles regarding the relations to be established between radiophonic societies, and the compilation of statistics regarding the procedure followed in each country.

Relays.—The Relay Committee has had under consideration the practical development of international relays, and the Council has decided that the International Union shall meet in Lausanne at the end of May next to discuss legal questions and problems of inadmissible propaganda, the extension of existing services, the control of wave-lengths, and other cognate matters.—*Reuter* (Geneva).

Italy.—New Stations.—The E.I.A.R.A. has acquired a large piece of land near the Piazza Mazzini, Rome, where a building is to be erected to contain a number of studios, as well as the equipment required for transmission, and administrative offices. The largest studio will be approximately 72 by 45 by 36 ft. in size; there will be four smaller studios, two of which will be reserved for talks and lectures. Sanction has also been given for the construction of a new station near Rome, about 25 km. from the city, to have a power of 50 kW (aerial). It will be put into operation this year, says *World-Radio*, and provision is also being made for a short-wave station near Rome; with an aerial power of 12 kW, it will be designed for frequencies between 12,000 and 3,750 kH (25 and 80 m.) and it will transmit normally on two wave-lengths with two aerials; the higher wave-length to be used for medium distances, and the lower for long distances, for instance, to the Italian colonies in East Africa.

Short-wave Signals.—Echo Phenomenon.—At the Academy of Science at Oslo on March 2nd Professor Stoermer lectured on the much discussed echo phenomena in connection with short-wave signals from the wireless station at Eindhoven, Holland, which were observed last October. A close watch was kept from Norway to Spitsbergen, but no further echoes were heard until the latter half of February, when they were heard in Norway, England, and Eindhoven. The time between the dispatch of a signal and the echo varied from eight to twenty-five seconds, and it is taken for granted that whatever the explanation may be the phenomenon is genuine and not imaginary. Professor Stoermer some time ago dealt with the occurrence in a British scientific journal, and predicted that there would be a recurrence of the echoes in the middle of February.—*Reuter* (Oslo).

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—March 15th. Victorian Railways. Armoured telephone cable. (B.X. 5126.)*

Beckenham.—Electricity Department. L.p. feeder pillars. (See this issue.)

Belgium.—Antwerp.—March 22nd. Municipal Council. Electrical cable and accessories. (B.X. 5124.)*

Cardiff.—March 19th. Electricity Department. E.h.p. and l.p. cables, and one natural draught cooling tower. (March 1st.)

Dundee.—March 13th. Electricity Department. L.p. cable. (March 1st.)

Edinburgh.—March 18th. Electricity Supply Committee. H.p. sub-station switchgear. (See this issue.)

March 25th. Electricity Supply Department. Underground insulated cables, conduits, pavement and road box frames and covers, house-service fuse boxes and fuse-boards, electricity supply meters. (February 15th.)

Earby.—March 20th. Urban District Council. Complete electricity distribution scheme. (See this issue.)

March 15th. One 1,500-kW motor convertor. (February 22nd.)

Fort William.—March 12th. North British Aluminium Co., Ltd. Material required for the electric power and lighting distribution system at the works near Fort William. (February 22nd.)

Gloucester.—March 25th. Electricity Department. Two 1,000-kW motor-generators. (See this issue.)

Harrogate.—March 23rd. Electricity Department. Cables, joint boxes, joint box compound, service meters, cut-outs and transformers for 12 months. (See this issue.)

Hull.—March 21st. Electricity Committee. Electrically-driven circulating water pump, motor, motor-starter, &c. (March 1st.)

March 21st. Electricity Committee. Three 1,500-kW motor-convertors. (See this issue.)

Ilford.—March 25th. Electricity Department. Supply of paper-insulated cables. (See this issue.)

Lancaster.—March 18th. Electricity Department. Two water-tube boilers (36,000 lb. per hour), with mechanical stokers, economisers, air heaters, steel chimney and fans. (February 22nd.)

London.—Central Electricity Board.—April 15th. North-West England and North Wales Electricity Scheme, 1928. 33,000-V overhead transmission lines. (March 1st.)

Metropolitan Asylums Board.—March 20th. Installation of automatic telephone system at the North-Western Fever Hospital, Lawn Road, Hampstead. (March 1st.)

Bethnal Green.—March 25th. Borough Council. Electric lighting installation at seven blocks of tenement buildings in Bethnal Green. (See this issue.)

Manchester.—March 18th. Central Purchase Committee. Incandescent electric lamps for 12 months. (See this issue.)

New Zealand.—Wellington.—April 15th. Post and Telegraph Department. Conductor cords. (B.X. 5098.)*

Oldham.—March 11th. Board of Guardians. Electric lamps and fittings. Form of tender from Mr. F. W. Fletcher, clerk to the Guardians, Union Offices.

Pentre, Rhondda.—March 30th. U.D.C. Electricity Department. A.c. ordinary and prepayment meters, mains and house service material. (March 1st.)

Perth.—March 11th. Corporation. Electric lighting installation for the housing scheme. Schedules (deposit £1) from T. McLaren, burgh surveyor.

Sheffield.—March 14th. Electricity Supply Department. Buildings and civil engineering works and constructional steelwork, transformers, pipework and valves, e.h.p. switchgear, battery shunting locomotive and accessories. (February 22nd.)

South Africa.—Johannesburg.—March 21st. Town Council. 65,500 porcelain insulators. (B.X. 5114.)* Weatherproof wire. (B.X. 5113.)*

Stourbridge.—March 21st. Board of Guardians. Electric lamps, shades, &c., for six months. G. F. James, clerk, 12, Hagley Road.

Warrington.—March 11th. Electricity and Tramways Committee. Motors and transformers. (February 22nd.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birmingham.—Electric Supply Committee. Accepted :—
Rotary converter for Belchers Lane sub-station.—Harland Engineering Co., Ltd.
Transformers for sub-stations.—Hackbridge Electric Construction Co., Ltd.
Works in connection with installation of grit collectors at Prince's power station, Nechells.—Thomas Piggott and Co., Ltd.
Constructional steel work for extensions at Water Street and at Chester Street sub-stations.—E. C. & J. Keay, Ltd.
Overhead cranes.—Herbert Morris, Ltd.
Vacuum dust-extracting plant at Summer Lane power station.—British Vacuum Cleaner and Engineering Co., Ltd.

Mental Deficiency Act Committee. Accepted :—
Installation of apparatus for electric lighting at Coleshall Hall Mental Home.—T. Glover.
Overhead equipment and underground cables.—Callender's Cable and Construction Co., Ltd.

Education Committee. Accepted :—
Electric generating plant and electric lighting installation for Boys' Camp School, Clent, and installation of apparatus for electric lighting at Dolphin Lane School.—Reynolds & Bradwell.
Installation of apparatus for electric lighting.—At Colmore Road School, Baxter & Impey; at Birches Green School, R. H. Newton; at King's Norton Secondary School, Ray Electrical Co.

Cleansing Committee. Accepted :—
Three electric vehicles.—Electricars, Ltd. One ditto.—General Vehicle Co., Ltd.

Black Notley.—Essex County Council. Accepted :—
Work in connection with electrical installation at new sanatorium (£1,879).—Christie Bros. & Co., Ltd.

Brentwood.—Essex County Council. Recommended :—
Electric wiring and installation of motors at Mental Hospital (£9,675).—Power Contracts, Ltd.

Brighton.—Lighting Committee. Recommended :—
Works at Southwick power station.
C.i. pipes, &c. (£1,791), Staveley Coal and Iron Co., Ltd.; valves, penstocks, &c. (£1,825), Blakeborough & Sons, Ltd.; centrifugal pumps (£2,936), Worthington Simpson, Ltd.; grid screens, platforms, &c. (£880), Ledward & Beckett, Ltd.
Two boilers (each of 75,000 lb. evaporation), £46,130.—Yarrow & Co., Ltd.
Extension to circulating water system at Southwick (£16,445).—Cochrane & Sons.

Chelmsford.—Essex County Council. Recommended :—
Two electric lifts at new county offices (£1,379).—Waygood-Otis, Ltd.

Cheltenham.—Stores Committee. Recommended :—
Electric light fittings.—Sharpe & Fisher, Ltd.

Chesterfield.—Electricity Committee. Accepted :—
Spare armatures for turbo condenser motors (£182).—English Electric Co., Ltd.
Governing control gear (£168).—Metropolitan-Vickers Electrical Co., Ltd.

Eastbourne.—Electricity Committee. Accepted :—
Assisted wiring scheme (16s. 6d. per point).—Blaine and Parris.

Guildford.—Electricity Committee. Accepted :—
Equipment in connection with supply to Clandon Park :—25-kVA kiosk (£100), Ferguson Pailin, Ltd.; 10-kVA kiosk (£35), W. Lucy & Co., Ltd.

Herne Bay.—Pier Committee. Accepted :—
New armoured cable from pier entrance to Grand Pier Pavilion (£120).—Herne Bay and District Electricity Co., Ltd.

Ilford.—Tramways Committee. Recommended :—
Rail grinder (£330).—Equipment and Engineering Co., Ltd.

Irish Free State.—Dublin.—City Commissioners. Recommended :—
Electric wiring of houses on the Emmet Road (Extension) Area (£5,271).—Hall & Srinson, Ltd.

Lamp Contracts.—The following contracts for electric lamps have been placed recently :—
Islington Borough Council.—Nelson Electric Co., Ltd.
Cheadle and Gatley Urban District Council.—Edison Swan Electric Co., Ltd.
London, Midland and Scottish Railway Co.—Siemens Electric Lamps and Supplies, Ltd.; Edison Swan Electric Co., Ltd.
Government of Northern Ireland.—Edison Swan Electric Co., Ltd.
Camberwell.—Public Service Committee.—General Electric Co., Ltd.

London. — Battersea. — Electricity Committee. Recommended :—
Two 500-kVA transformers (£467), British Electric Transformer Co., Ltd.; switchgear (£1,167), Bertram Thomas.
Earthing resistance system at power station (£204).—Metropolitan-Vickers Electrical Co., Ltd.
Health Committee. Accepted :—
Lamps and apparatus for Solarium at Southlands (£187).—Watson & Sons (Electro-Medical), Ltd.

Hammersmith.—Electricity Committee. Annual contracts. Recommended :—
Stoneware conduit.—Doulton & Co.
Insulating compound.—Dussek Bitumen Co., Ltd.
Cables.—Connollys (Blackley), Ltd.
Insulated wires.—W. Geipel, Ltd.
House service and joint boxes.—W. Lucy & Co., Ltd.
Meters.—Chamberlain & Hookham, Ltd., and Metropolitan-Vickers Electrical Co., Ltd.
Meter boards.—W. T. Henley's Telegraph Works Co., Ltd.

Metropolitan Asylums Board.—Works Committee. Installation of electric light at the Southwark Casual Ward :—

H. Lewis & Co. (Recommended.)	£105
A. Hawkins & Sons	160
Alpha Manufacturing & Electrical Co., Ltd. ...	160
S. Reed & Sons	161
Hall's Longitudinal Lighting Co., Ltd.	171
Read & Partners, Ltd.	178
Toy & Winslow	193
J. Briggs, Electrical Contractors, Ltd.	197
Harden & Chinery	219
J. Nicoll & Sons	284

London County Council.—Education Committee. Electrical installation at Beaufoy Institute :—

Stegman & Co. (Recommended)	£390
Electrical Installations, Ltd.	435
Buchanan & Curwen	510
Smethurst & Co. (London), Ltd.	515
W. H. Gaze & Sons, Ltd.	558

Highways Committee. Cables, reactors and control battery in connection with the new switchgear for Greenwich power station :—
Cables and reactors :—

General Electric Co., Ltd.	£2,075
Standard Telephones & Cables, Ltd.	2,242
British Thomson-Houston Co., Ltd.	2,278
Callender's Cable & Construction Co., Ltd. ...	2,340
Siemens Bros. & Co., Ltd.	2,342
W. T. Glover & Co., Ltd.	2,348
Macintosh Cable Co., Ltd.	2,372
Johnson & Phillips, Ltd.	2,405
British Insulated Cables, Ltd.	2,399

The Committee reported that an examination of the various tenders showed that it would be to the Council's advantage

to divide the work. The lowest offer for the reactors was that of the General Electric Company, Ltd. (£802, including provisional sum), and for the remaining items that submitted by Standard Telephones and Cables, Ltd. (£1,234, including provisional sum); and, it having been ascertained that these two companies would be prepared to enter into contracts for part only of the items of the section, the Committee has accepted the tender of the former company so far as it relates to reactors and that of the latter company so far as it relates to the remaining items.

Control battery :—

Edison Swan Electric Co., Ltd. (Accepted.) ...	£452
Alton Battery Co., Ltd.	562
Tungstone Accumulator Co., Ltd.	628
Fuller Accumulator Co. (1926), Ltd.	647
D.P. Battery Co., Ltd.	672
Pritchett & Gold and E.P.S. Co., Ltd.	672
Chloride Electrical Storage Co., Ltd.	679
Premier Accumulator Co. (1921), Ltd.	679
Hart Accumulator Co. (1926), Ltd.	684
British Thomson-Houston Co., Ltd.	690
Tudor Accumulator Co., Ltd.	695
Siemens Bros. & Co., Ltd.	746

Maidenhead.—Town Council. Accepted :—
Two additional 100-kVA transformers, with tapping switches (£244).—Hackbridge Electric Construction Co., Ltd.

Newbury.—Main Drainage Committee. Accepted :—
Electrically-driven pumping plant at sewage works (£899).—Hathorn, Davey & Co., Ltd.

Stoke-on-Trent.—Electricity Committee. Accepted :—
Steam, water piping, valves, &c., in connection with central power house extensions (£11,939).—Aiton and Co., Ltd.
Supply of cables and laying mains for 12 months.—Callender's Cable and Construction Co., Ltd.
Sub-station switchgear.—Metropolitan-Vickers Electrical Co., Ltd.
Sub-station transformers: 200 kVA, British Thomson-Houston Co., Ltd.; 800 kVA, Metropolitan-Vickers Electrical Co., Ltd..
Overhead wiring and services for 170 houses at Hanford estate (£477).—Barnett & Soans.
Watch Committee. Accepted :—
Electric lighting installation at Stoke Police Station (£96).—Painter & Madew.

Wimbledon.—Electricity Committee. Accepted :—
One 2,000-kVA Transformer (£635).—Metropolitan-Vickers Electrical Co., Ltd.
L.p. switchgear (£2,065).—George Ellison.
H.p. switchgear (£1,259).—English Electric Co., Ltd.
Extra-h.p. switchgear (£2,922).—A. Reyrolle & Co.

York.—Education Committee. Accepted :—
Electric lighting installation at Clifford Street Technical Institute (£490).—Corporation Electricity Department.
Watch Committee. Accepted :—
Installation of cables to police boxes (£158); supply of lighters and heaters (£54).—Corporation Electricity Department.

Forthcoming Events.

Physical Society.—Friday, March 8th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Royal Institution of Great Britain.—Saturdays, March 9th and 16th. 21, Albemarle Street, W. "Molecular Motions in Rarefied Gases." Sir Ernest Rutherford, P.R.S.

Electrical Power Engineers' Association (London Local Technical Group).—Tuesday, March 12th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "The Design of Feeder Pillars, Cable End Boxes, &c." Mr. P. Dunsheath.

(Manchester Local Group).—Thursday, March 14th. Geographical Hall, Manchester. 7.45 p.m. "Modern Switchgear Practice." Mr. G. Cluley.

Electroplaters' and Depositors' Technical Society.—Wednesday, March 13th. Northampton Polytechnic Institute, E.C. 8.15 p.m. "Electroplating Plant." Mr. J. W. Perring.

Institution of Engineers-in-Charge.—Wednesday, March 13th. St. Bride Institute, E.C. 7.30 p.m. "Recent Developments in Superheating." Mr. J. S. Evenden.

Royal Society of Arts.—Wednesday, March 13th. John Street, Adelphi, W.C. 8 p.m. "Loud Speakers." Mr. R. P. G. Denman.

British Electrical Development Association. — Thursday, March 14th. Piccadilly Hotel. 7 for 7.30 p.m. Annual dinner.
Friday, March 15th. Royal Society of Arts, John Street, Adelphi. 7.30 p.m. "Water Heating Development."

Institution of Electrical Engineers.—Thursday, March 14th. Institution, London, W.C. 6 p.m. "Electrical Insulating Papers for the Manufacture of Power Cables." Messrs. T. N. Riley and T. R. Scott. "The Prevention of Ionisation in Impregnated Paper Dielectrics." Messrs. S. G. Brown and P. A. Sporing.

(North-Eastern Centre).—Monday, March 11th. Armstrong College, Newcastle-on-Tyne. 7 p.m. Faraday Lecture, "How Electricity Does Things." Mr. Ll. B. Atkinson.

(Scottish Centre).—Friday, March 8th. Cowdray Hall, Aberdeen. Faraday Lecture, "How Electricity Does Things." Mr. Ll. B. Atkinson.
Tuesday, March 12th. North British Station Hotel, Edinburgh. 7 p.m. "The Construction of the Grid Transmission System in Great Britain." Messrs. J. Wright and C. W. Marshall.

(Western Centre).—Monday, March 11th. Bristol. 6 p.m. "Electricity in Agriculture, with special reference to Electro-culture." Mr. W. Phœnix.

(North Midland Centre).—Tuesday, March 12th. Hotel Metropole, Leeds. 7 p.m. Annual dinner.

(Dundee Sub-Centre).—Thursday, March 14th. University College, Dundee. 7.30 p.m. "Overhead Electric Lines." Mr. W. B. Woodhouse; "Distribution," Mr. W. Woodiwiss.

(North-Eastern Students' Section). — Wednesday, March 13th. Joint meeting with the North-East Coast Institution of Engineers and Shipbuilders, Graduate Section. Bolbec Hall, Newcastle-on-Tyne. 7.15 p.m. "The Problem of High Voltage Measurement." Mr. M. Waters.

(London Students' Section).—Friday, March 15th. Institution, London, W.C. 6.15 p.m. "Wave-Form Analysis." Mr. C. F. J. Morgan.

British Institute of Radiology (incorporated with the Röntgen Society).—Thursday, March 14th. 32, Welbeck Street, W. 8.30 p.m. Ordinary meeting.

Association of Mining Electrical Engineers (Western Sub-Branch).—Saturday, March 16th. 60, Wind Street, Swansea. Informal discussion of the report of H.M. Electrical Inspector of Mines for 1927.

Notes.

The E.P.E.A. (Western Section) Dinner.

The ninth annual dinner of the London Western Section of the Electrical Power Engineers' Association was served at St. Ermin's Hotel, Westminster, on March 2nd, Mr. E. F. Hall presiding over a gathering of some 100 members and guests, and their ladies.

Mr. P. E. Rycroft, M.B.E., M.I.E.E., following the loyal toast, proposed "The Association," enumerating its virtues and achievements; no scheme it had proposed had ever proved to be otherwise than of practical benefit. They all wanted to get on, and wished the world to appreciate the importance of the engineer; the E.P.E.A. would continue to raise his status if it were given the support it deserved.

Mr. A. E. Ricketts (junior vice-president of the E.P.E.A.) responded.

Mr. W. J. Oswald, A.M.I.E.E., toasted the ladies, but the Mayoress of Hammersmith (Councillor Mrs. B. J. Samuels), who was to have replied, was prevented by indisposition from being present.

Mr. J. F. Sarvent proposed "Our Section and Our Chairman," and Mr. E. F. Hall briefly replied.

A musical entertainment contributed materially to the enjoyment of a successful function.

Educational.

The Scottish Education Department has issued a circular (Rules 4) describing the arrangements and conditions for the award of the national certificates and diplomas of the Institution of Electrical Engineers in conjunction with the Department. Copies of the circular may be obtained at H.M. Stationery Office, for 2d. net.

Appointments Vacant.

Third class electrical engineering draughtsman (temporary) (£165) for the Metropolitan Asylums Board. Switchboard attendant for the Basingstoke Corporation Electricity Department. System control engineer (450 taels per month), assistant charge engineers (350 taels per month) (tael=2s. 7d.) for the Shanghai Municipal Electricity Department. Lecturer in electrical engineering for the Rugby College of Technology and Arts. Linesman jointer for the Milford Haven Urban District Council. Plumber jointer for the Willesden District Council Electricity Department. Three consumers' accounts clerks (£135); assistant constructional (electrical) engineer (£416), for the Manchester Corporation Electricity Department. Assistant engineer in the Electrical Department of the Buenos Ayres and Pacific Railway, Argentina (£418). (See our advertisement pages to-day.)

E.A.W. Activities.

On February 12th the Birmingham and Midlands Branch of the Electrical Association for Women held an "Outlet Campaign" meeting, at which Mrs. L. A. Wilson, M.B.E., spoke on "House Problems from the Women's Point of View." Mr. T. R. Martin spoke on the "Red Seal" Campaign in Canada, and Mr. Forrest, M.I.E.E., spoke from the supply engineer's point of view.

The North Wales Branch of the Association had an enjoyable visit to the Sunlight Soap Works at Port Sunlight on February 5th. Mr. Price F. White, borough electrical engineer, Bangor, gave a lecture on "Domestic Appliances" at Llanfairfechan on February 22nd, and at Pennaenmawr on February 28th.

King's College Centenary Appeal.

In connection with the centenary commemoration this year of the establishment of King's College, University of London, an appeal is being made for £350,000 to meet requirements for buildings and endowments. The College is now, with the approval of the Senate, acquiring a 200 years' lease of an area of nearly 5,000 sq. ft. above the Aldwych station. Plans have been prepared for the erection on this area of a new building to accommodate several departments which are now inadequately housed. The attention of our readers is drawn to the special arrangements which are being made to secure endowments for the Chair of Physics, now occupied by Prof. E. V. Appleton, F.R.S., and the Chair of Electrical Engineering which, since the untimely death of Prof. J. Hopkinson, F.R.S., in 1898, has been held by Prof. Ernest Wilson, Wh.Sch. The discoveries and inventions which have been made in the laboratories of the College, the promise of new developments contained in the original investigations which are now being carried on, and the continuous supply of personnel trained in these two departments, are of immense value to the electrical and allied industries, and it is hoped that the firms to whose benefit the College contributes in so many ways will generously support the ambition to place the two chairs in the position of dignity and financial security which their importance deserves.

Some of the discoveries, inventions and investigations made in the laboratories of the College during the last hundred years are: electric telegraph, Prof. Sir Charles Wheatstone, F.R.S., and W. F. Cooke; invention of Daniell cell, J. F. Daniell, F.R.S.; discovery of existence of electromagnetic waves, Prof. James Clerk Maxwell, F.R.S.; quantitative basis of the design of the filament of the thermionic valve, Prof. O. W. Richardson, F.R.S.; investigations on wave form of atmospherics and the effects of thunderstorms on radio-telegraph receivers, measurements of the height and investigations on the influence of the Heaviside Layer in causing signal fading, Prof. E. V. Appleton, F.R.S.; properties of selenium now utilised in selenium cells, Prof. W. Grylls-Adams, F.R.S.; invention of continuous-current dynamo and invention of shunt-wound dynamo, Prof. Sir Charles Wheatstone, F.R.S.; theory of parallel running of alternators, differential method of testing dynamo electrical machines and invention of three-wire system, Prof. John Hopkinson, F.R.S.; and investigations into the corrosion of metals for overhead wires, Prof. Ernest Wilson, Wh.Sch., M.Inst.C.E., M.I.E.E.

The above summary indicates the extent of the indebtedness of the electrical and allied industries to the departments of physics and electrical engineering in King's College during the past hundred years. To-day the two departments are anually supplying trained workers to meet the demands of modern industry, while in addition to their work of teaching, all members of the staff are actively engaged in the prosecution of research. For example, among the subjects now being investigated in the Wheatstone Laboratories, under the general supervision of Prof. O. W. Richardson, F.R.S., and Prof. E. V. Appleton, F.R.S., are:—wireless wave propagation, investigations on soft X-rays, and generation of electrical oscillations by gas discharges.

The similar investigations now being carried on in the Siemens Electrical Laboratory, under the direction of Professor Wilson, include such subjects as spark potential, a.c. commutator motor, moving-coil telephones, properties of magnetic oxides, and atmospheric corrosion of electrical conductors.

Donations in response to the appeal may be sent to one of the treasurers—The Rt. Hon. Reginald McKenna, or Sir Edward Troup, K.C.B.—at the College; or they may be sent to the college bankers—Messrs. Coutts & Co., at 440, Strand, W.C.2, for the credit of King's College centenary appeal account for the physics and/or electrical engineering endowment fund.

Local Societies.

At a meeting of the Paisley Association of Electrical Engineers recently, Mr. James Orr described the electrical equipment at "Paisley Abbey."

Speaking at the annual dinner of the electrical staff of the Doncaster Collieries' Association (Limited) and the Associated Collieries at Doncaster on March 2nd, Mr. C. C. Bleach, chief electrical engineer to the Doncaster Collieries' Association, said that in 1928 the Association generated 31¾ million units of electricity, as against 16¼ million units in 1922. Outside undertakings last year took seven million units, an increase for the year of a million units.

A Reconstructed "Underground" Station.

The reconstruction of Charing Cross underground station is now practically completed. Work was commenced in 1926, and has been carried out gradually in order to cause as little inconvenience to traffic as possible. The need for construction became apparent when the new Morden tube increased the number of passengers through the station exchanges by 26,000 a day, and the new station is capable of dealing with at least 50,000,000 per year. The work commenced with the construction of a new circulating area beneath the District Railway at a point where passengers could conveniently change between that railway and the Bakerloo and Hampstead tubes below. This was followed by the installation of two escalators which linked up the intermediate hall with the new south-bound platform of the Hampstead tube, and two escalators which ran from the street level to the intermediate landing. The latter two were the first escalators to be installed at a District Railway station. The final stage was the construction of a new booking hall to replace the inadequate arcade booking office. The new hall is three times as large as the old one and has an area of 10,000 sq. ft. Automatic machines are to be installed, and in addition there will be a booking office for the issue of long-distance tickets, change-giving kiosks, and a special office for the issue of season tickets. The station fronts on Villiers Street and the Embankment are floodlighted, and the booking hall is illuminated by means of a system of lights situated outside the windows of the clerestory roof. The question of directing passengers using the station subways has been considered, and a new scheme of coloured route signs has been adopted. In the subway leading to the west-bound platform of the District Railway from which trains proceed to Victoria, green lamps have been installed at distances of about 15 ft. Similarly, the subway to the Bakerloo north-bound platform for Piccadilly Circus has red guide lights, and the subway to the Hampstead south-bound platform for Waterloo or Morden, blue lights. This scheme is only of an experimental nature at present. Another experiment is that of employing small station names on the walls opposite the platforms. It is thought that by having several small signs, the difficulty experienced by passengers, when the trains are full, to see the regular station name-plates, will be overcome.

The Batti-Wallahs' Society.

A very well attended luncheon of the Batti-Wallahs' Society was held at the Hotel Cecil, on Wednesday, February 27th, the chief guest being Lt.-Col. K. Edgcumbe, R.E. (T.), president, Institution of Electrical Engineers.

The president, Mr. R. W. Hughman, who occupied the chair, introduced Col. Edgcumbe in an exceedingly amusing speech, the main theme of which was the relative importance of the Batti Wallahs Society and the institution itself.

Col. Edgcumbe, who addressed the gathering on the subject of "Prosperity," suggested that a fair measure of prosperity could be taken as being represented by the number of good things which a fair day's work could provide for the individual. He stressed the enormous variation between the wealth of individuals in such countries as Austria and the United States. He thought that the only way in which we could increase our own prosperity was to increase the quantity of commodities which we all produce. The people of the United States had realised very clearly as a nation that a large output per individual was the surest road to wealth. Without discussing the relative merits of Free Trade and Protection, he believed that it could hardly be disputed that there was something wrong when we continued to import goods which we could readily produce at home at a period when the country was suffering so disastrously from unemployment. Government action could not help us and he hoped that we might be preserved from visionaries who desired to re-make the world on some fanciful scheme of their own without any study of the economic factors which had been brought about by centuries of slow growth. He took a rather hopeful view of the coal, iron and steel industries, and believed that considerable improvement could be looked for during 1929. Success could be said to be due to constancy of purpose, and he trusted that our purpose in the future would be to increase the home output by every possible means and for our people to buy British goods.

Mr. Snow Huddleston in a short speech thanked the president for the pleasure which his presence and his address had given the society.

Among those present were:—Col. R. E. Crompton, Mr. Arch. Page, Mr. A. A. Campbell Swinton, Mr. Ll. B. Atkinson, Mr. Roger T. Smith, Sir George Sutton, Sir Montague Hughman, Sir Robert Donald, and Messrs. A. H. Dykes, L. L. Robinson, J. Christie, P. V. Hunter, H. V. Couzens, W. E. Highfield, W. McClelland, H. J. S. Mackay and E. Reeves.

On Friday, March 1st, the Society held its twenty-third annual dinner and dance at the Hotel Cecil, London. Mr. Ll. B. Atkinson, in proposing the toast of the Society and its president, Mr. R. W. Hughman, said the Society was doing excellent work for the industry. After dinner the evening was spent in dancing: picturesque headdresses and favours were provided for the ladies, and "brass hats" for the gentlemen, the officials sporting admirals' cocked hats. The evening was voted an enormous success by the huge company present, and the biggest hall at the Hotel Cecil has already been booked for next year's dance, on Friday, March 21st, 1930.

Wandsworth Electricity Charges.

Wandsworth Borough Council on February 26th decided to ask the Electricity Commissioners to reopen an inquiry into prices charged in Wandsworth by the County of London Electricity Supply Co. Alderman A. W. Mathias said that the whole borough was groaning under "the excessive charges." Under the company's multi-part tariff only a few people benefited, while the vast majority did not. Fourpence a unit was the top price which the public should pay. The company had not offered the more fair and generous terms which might have been expected.—*The Times.*

The Co-ordination of Societies.

The seventh annual corporate meeting of the Institution of Chemical Engineers on March 20th will be held at Grosvenor House, Park Lane, London, W.1, under the chairmanship of the president, Sir Alexander Gibb. Non-members are invited to attend the delivery of Sir Alexander's address at 12.15 p.m. He has on various occasions spoken on the desirability of closer union between the many engineering institutions, and is taking this opportunity to develop the theme under the title of "The Co-ordination of Engineering Institutions and Societies"; members of other engineering bodies will no doubt find therein matter for consideration.

London Electrical Engineers (T.A.).

The parade of the detachment of the 27th A.A. Battalion, R.E. (London Electrical Engineers) of the Territorial Army, commanding officer, Lt.-Col. C. H. S. Evans, O.B.E., going to Easter camp will be in the Drill Hall at 10 a.m. on March 29th.

Heat Transmission in Buildings.

The Department of Scientific and Industrial Research has published Building Research Special Report No. 11 on Heat Transmission, the first portion of which contains the values of the thermal resistances of various types of walls and building materials. They will, it is thought, be found more convenient in practice than thermal conductivities. In addition, an alignment chart is given for the derivation of an approximate overall "air-to-air" transmission coefficient, so much used by heating and ventilating engineers, under different conditions of exposure. The second part of the report is a résumé of the phenomena affecting heat transmission through the fabric of buildings and the laws governing the transfer. Special attention is paid to the effect of various factors on overall coefficients of conductivity.

Notes from Switzerland.

The annual statistics concerning the output of electrical energy in Switzerland are now to hand for the past year, and it appears that the total may be divided as follows:—Energy produced in stations fed by natural waterfalls or rivers, 3,622 million kWh; energy produced in stations fed by seasonal reservoirs, 457 million kWh; energy produced in stations fed by thermal installations, 2 million kWh; energy imported and used in Switzerland, 16 million kWh, making a grand total of 4,097 million kWh. Out of this amount 2,276 million kWh has been employed in the country itself, and the remainder has been exported, to the great profit of the Confederation and electrical societies in general. The different uses to which this energy has been put may be indicated by a few figures showing how some of it has been employed. Energy employed for electric traction other than the Swiss Federal Railways, 192 million kWh; energy employed for electro-chemistry and metallurgy (not including that produced by private power stations belonging to such works), 494 million kWh; energy employed for general usage, 1,590 million kWh. The stations belonging to the Swiss Federal Railways, the Swiss Centrals, and private stations have produced 5 million kWh.

The Société Romande d'Electricité has just celebrated the twenty-fifth anniversary of its foundation by the distribution of 8,000 francs amongst the various hospitals, orphanages, almshouses, and anti-tuberculous societies of the region, and other charities. Over and above the said sum, the S.R.E. has granted another eight thousand francs to aid research; five thousand of this amount goes to the fund for old pupils of the Ecole d'Ingénieurs at Lausanne, and the rest to the laboratories of the University of Lausanne and of the Collèges of Vevey, Montreux, and Aigle.

An Automatic Rectifier Sub-station in Germany.

The inter-urban railway between Haspe, Vorde and Breckenfeld, in Germany, was recently electrified on the 1,200-volt direct-current system, which comparatively high voltage was chosen in order to feed from one point the 11¼-miles section negotiated by rolling stock up to a total weight of 152 tons. The necessary energy is supplied at 10,000 volts, 50 cycles, three-phase, and is transformed to 1,200 volts d.c. by two mercury-arc rectifiers at the Schutzenhof sub-station near Haspe, the plant being so designed as to work automatically and quite independently of attendants. Each rectifier has a continuous capacity of 450 kW, and is capable of carrying peak loads of 650 kW for ten minutes and of 850 kW for two minutes. Ordinarily, only one is in service, the second being used more or less as a stand-by for the peak-load hours; it is eventually intended that the two rectifiers shall work in parallel and a third be installed as a stand-by.

Each rectifier set is protected against overload on the h.p. side by oil circuit breakers fitted with time-limit releases.

The cathodes of the rectifiers are connected to the rails, so that no dangerous voltages can occur at the rectifier vessels. The anodes are at a high potential to earth and are protected from contact by a wire guard. The main vacuum chamber within the cylindrically-shaped rectifiers is water-jacketed. The chamber is elliptically-shaped and supports the anodes from six flanges in its roof, below the cathode. The evacuation of the rectifier is effected in the usual manner by a three-stage mercury-vapour pump and a two-stage oil pump, to which it is connected, *via* the pre-vacuum chamber. All switching processes are effected by relays in the correct sequence, and the station automatically adjusts itself to the fluctuating demand on the d.c. network, *i.e.*, the individual transformers and rectifiers are automatically switched in and out as the load increases and decreases. The d.c. feeder network is also under automatic control: on the occurrence of a short-circuit, or overload, the line beaker disconnects the section affected and only re-connects it when the cause of the disturbance has been eliminated. If the demand of the railway exceeds the maximum capacity of the station, the entire plant is automatically shut down, but the station is not entirely switched out of service, because, after disconnection, the rectifiers are again switched on to the bus-bars and the automatic line breakers continually test whether there is an excessive demand on their respective feeder circuits before closing them. Should an excessive load be evident on any particular feeder, it is even then not finally disconnected, but continues to be tested at short intervals before the line breaker is opened definitely after a elapse of time, and signals are sent to the main control station that a fault which requires immediate removal has occurred. The station can be put into service either by push-button control or by time switches.

The automatic equipment of the sub-station was carried out by the A.E.G., of Berlin, and has fully satisfied expectations from the standpoint of both economy and technical efficiency. Indeed, it is claimed that the station operates more reliably and gives rise to less disturbances due to faulty switching operations than hand-operated plant does.

Electricity and Traffic Control.

Some interesting comments are given in the *Yorkshire Observer* on the application of electric colour signals to the control of traffic. The system has made rapid progress and met with marked success, not only in America, but on the Continent. It is less than a year ago that steps were taken to test this method of traffic control in this country. The original signals were installed in Leeds, at the Bond Street and Park Row crossing, and the success with which they have worked has led to the general consideration of their use by many other road authorities in Great Britain. Within a period of 11 months some 20 authorities have adopted the use of the signals, and the number in use in Leeds has increased to seven.

It is found that road users speedily become acquainted with the signal implications, and that within a few days the usual traffic policeman may be withdrawn. So far the use of signals in this country have been confined to busy thoroughfares in towns, but the signals should be equally successful at important road intersections or dangerous crossings in the country. The rapid growth of the electric supply industry within the last few years and the extension of electric mains into urban and rural districts has made possible the installation of these signals on high roads outside the towns.

As it was recently stated that £20,000 was being spent on traffic control annually in the area administered by the West Riding police, the call for a wider adoption of electric traffic control seems justified on an economy basis alone. The maximum initial cost of installing a complete set of signals is less than a year's salary for a constable, while the annual running costs are approximately one-twelfth.

Electric Lifts.

In a general review of the above subject brought before the Junior Institution of Engineers by Mr. L. S. Atkinson on March 1st, the author said that the immense height of many buildings in America necessitated the rapid travel of elevators, and many of these were now operating at speeds of 800 ft. per min. and over, but in England the greatest speed was probably not more than 450 ft. per min. The hydraulic lift of the direct-acting type was practically obsolete, and the indirect or suspended type nearly so, one of their chief disadvantages being the difficulty of efficient counterbalancing, due to the necessity for such lifts being heavy enough, when unloaded, to drive the water out of the cylinder at a rate which would give the lift a reasonable speed of descent. Assuming that an electric lift had to raise a load of 2,000 lb., 40 per cent. of the load could be counterbalanced; whereas an hydraulic lift would have to raise that load plus the weight of the car and a negative balance as above—a total possibly of 5,000 lb. The evolution of the electric lift had been rapid, the traction type being the latest and most efficient, and particularly suitable for high buildings and for working at high speeds; it also permitted of a greater measure of standardisation, and consequently decreased manufacturing costs. It had beside the advantage of an important safety feature, the impossibility of overwinding. In this type of lift one end of the sus-

pension ropes were fastened to the lift and the other to the balance weight and they passed over a grooved traction sheave driven by the motor, and imparting motion to the lift, the friction between the ropes and sheave being depended upon to transmit the driving force from the motor to the car and balance weight, speed reduction being effected by worm gear. A gearless traction machine used for high car speeds of over 400 ft. per min. had the traction sheave mounted directly on the motor shaft. Braking was done by springs which were compressed electromagnetically and released the brake shoes while the motor was running. The operation of micro floor levelling gear was described, together with the various methods of control, announcing signals, and so on.

American Notes.

During the year 1928 the production of electricity by water power in the United States of America totalled 34,747,188,000 kWh, or 39.6 per cent. of the total output. The production of electricity by fuels totalled 53,103,932,000 kWh. Of this amount, 365,623,000 kWh was produced by burning wood, leaving a balance of 52,738,309,000 kWh generated by means of the combustion of coal, oil and gas. Evaluating the oil and gas into equivalent tons of coal, a total of 46,348,846 tons of coal (or its equivalent) was used, or an average figure of 1.76 lb. per kWh. This compares with an average of 1.84 lb. in 1927, and represents an average gain in plant efficiency of nearly 4½ per cent. during the year. It stands in striking contrast with the 3.2 lb. required by the average plant in 1919.

The effects of centralisation of ownership or control and the absorption of independent generating stations accompanying the extension of transmission lines is shown by the most recent State summaries released by the United States Bureau of the Census. The number of individual generating stations in the various States has either remained stationary or else has shown a considerable decrease during the five-year period, 1922-27. A great many of the smaller enterprises have been superseded by co-ordinated systems whose current is supplied by large, centrally-located plants, whose greater size and more effective operation of machinery are evident in the remarkable increase in the average horse-power per engine and in the increase in output per kW of capacity which the Census figures show.

In Colorado the total number of undertakings decreased from 79 in 1922 to 72 in 1927. The number of power houses has increased from 69, with a total capacity of 112,530 kW, to 86, with a total capacity of 196,919. In Louisiana a tremendous growth in electricity output is evident, although the number of stations has only increased slightly, and the number of undertakings has shown a decrease from 81 in 1922 to 51 in 1927. The total number of undertakings in Maine has decreased from 82 in 1922 to 70 in 1927. The number of power houses has remained the same, but their capacity has doubled during this five-year period.

In Massachusetts the total number of undertakings has grown slightly, from 117 in 1922 to 123 in 1927, while the number of power houses has remained practically the same, being 90 in 1927, as against 87 in 1922. The total number of undertakings in Minnesota declined by 25 per cent. during the same period. In 1922 this total stood at 254; in 1927 it had dropped to 190. The number of generating plants shows a similar rate of shrinkage, although their capacity has grown by nearly two-thirds during those five years.

In Missouri the continued absorption of small isolated undertakings into larger co-ordinated systems seems to have taken place with unprecedented rapidity. In 1922 the total number was 240; in 1927 it had dropped to 122. The number of generating stations also shows a large shrinkage, although their capacity has grown by more than half as much again during those five years. Electric service has steadily increased in New Hampshire during the five-year period. The installation of generating machinery and the output of electricity has more than doubled, while the number of customers has grown from 64,158 at the end of 1922 to 106,249 at the end of 1927.

In Oregon there has been a marked decrease in the number of undertakings. A shrinkage of 22 is noted in the number of companies, representing the net result of a gain of 9 and a loss of 31, while two municipal enterprises have been absorbed into private systems. The most striking fact that the Census figures reveal is, however, the relative growth of steam generation in a State supposedly blessed with considerable undeveloped water-power resources. Steam engines and turbines aggregated 37,680 h.p. at the end of 1922; at the end of 1927 these totalled 136,905.

In Washington a large increase in hydro-electric development is noted, chiefly because of the completion during the same period of the first Skagit plant of Seattle, the first installation of the Lake Cushman plant of Tacoma, the Baker River plant of the Puget Sound Power and Light Company, the Chelan plant of the Washington Water Power Company, and numerous other (though smaller) installations. Water wheels and turbines have grown from 388,024 h.p. capacity in 1922 to 698,729 h.p. in 1927.

The total number of watt-hour meters employed on the system of the New York Edison Company and associated electric companies serving the metropolitan area last year was 2,119,636, as compared with 1,985,250 meters at the end of 1927. In 1928 the companies comprising the system tested a total of 518,974 meters. Of these, 507,482, or 97.78 per cent., were found to be correct, according to Public Service Commission standards, and only 1,330 meters, or twenty six one hundredths of 1 per cent., were found fast. Those recording slow numbered 10,172, or 1.96 per cent. The percentage found correct increased from 97.33 per cent. in 1927 to 97.78 per cent. in 1928. Of the 518,974 tests made throughout the system in 1928, 12,724 were complaint and Public Service Commission tests, made on complaint of customers that their meters were fast, and of these only 78 were found fast, while 554 were found to be slow. The remainder, 12,092, were recording according to Public Service Commission standards.

Institution Note.

American Institute of Electrical Engineers.

Lamme Medal Awarded.—The Lamme Medal Committee of the Institute has awarded the first (1928) medal to Mr. Allan Bertram Field "for the mathematical and experimental investigation of eddy-current losses in large slot-wound conductors in electrical machinery." The Lamme Medal was founded as a result of a bequest of the late Benjamin G. Lamme, chief engineer of the Westinghouse Electric and Manufacturing Company, who died on July 8th, 1924, to provide for the award by the Institute of a gold medal (together with a bronze replica thereof) annually to a member of the A.I.E.E. "who has shown meritorious achievement in the development of electrical apparatus or machinery," and for the award of two such medals in some years if the accumulation from the funds warrants.

Mr. A B. Field has been associated for some years past in the capacity of consulting engineer with the Metropolitan-Vickers Electrical Co., Ltd., and the work for which the distinction has been conferred is well known to designers of large electrical machinery. The investigation, the results of which were embodied in a paper presented to the A.I.E.E. in 1905, constituted the first thorough analysis of the subject, and provided for the first time a system by means of which the eddy-current losses for any given design of large machine could be predetermined. The importance and completeness of the work are indicated by the fact that the system, to which little has been added by later investigators, remain still the acknowledged basis for the calculation of eddy-current losses in turbo-alternators and other machines which are being built in ever-increasing capacities. The first award of the Lamme Medal to an engineer of British birth and training, of British and American experience, and now of British residence, is an honour to be proud of indeed.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

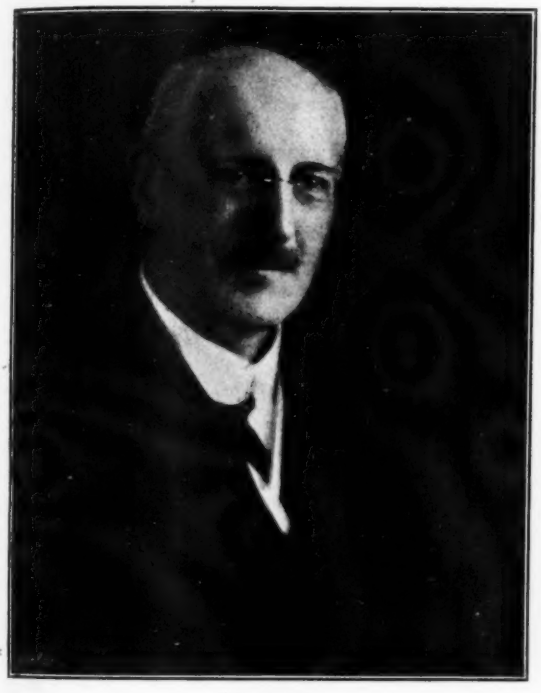
The New Year Honours.

Particulars appear in our leaderette pages to-day of the honours that His Majesty has conferred upon certain well-known electrical gentlemen. Accompanying the present notes we are able to give photographs of the two new electrical knights—Sir J. A. Fleming, F.R.S., and Sir T. F. Purves, M.I.E.E.

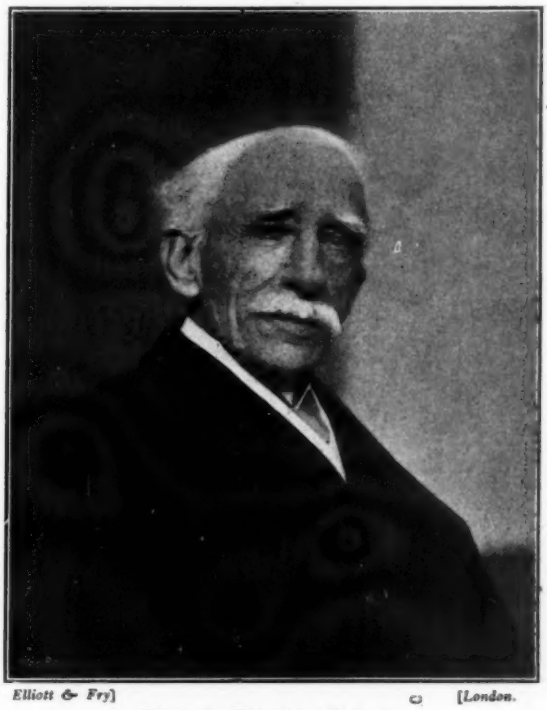
The following are the main advances of the Post Office system of electrical communications that have taken place during Col. Sir T. F. Purves's period of office as engineer-in-chief :—

The provision of a complete network of underground trunk telephone cables connecting together all the important towns of Great Britain, and involving the construction of many thousands of telephone repeaters, equipped with valve amplifiers, which have made it possible to transmit speech satisfactorily, without any limit of distance. The rapid extension of telephone communication between Great Britain and the other countries of Europe, to an extent which already includes all the principal

nations. The establishment of public radio-telephone services between Great Britain and the United States, and the extension of these Anglo-American radio links to the telephone systems of most of the countries of Europe on this side, and to practically the whole of the American Continent on the other side. The establishment of the Imperial radio-telegraph services to Canada, South Africa, Australia, and India. The design and introduction of an automatic telephone system for London, and the rapid extension of the automatic telephone system throughout the other cities and towns of Great Britain. Col. Sir Thomas Purves served during the Great War as major in the Corps of Royal Engineers, and was in charge of the design and supply of new forms of technical equipment for military communications. He has since been colonel of the 44th (London Home Counties) Division of the Royal Corps of Signals. As Engineer-in-Chief of the Post Office he is the head of an engineering staff of about 35,000 men, and is responsible for an expenditure approaching £20,000,000 per annum. He has represented the British Government abroad on many special commissions, and was head of the



Sir T. F. Purves, M.I.E.E.



Elliott & Fry [*London.*

Sir J. A. Fleming, F.R.S.

The Two New Knights.

British Delegation to the world radio conference held at Washington, 1927, under the presidency of Mr. Hoover, for the purpose of establishing international regulations governing radio communication. He has for some years acted as President of the international commission on the development and unification of telephone engineering, which meets annually in Paris.

Alderman J. W. LONGLEY, consulting electrical engineer, and recently-elected chairman of the Bradford Corporation Electricity Committee, has been elected chairman of the West Riding Conference of Local Authorities in connection with the co-ordination of electricity supply in the Aire and Calder Electricity District.

Mr. L. W. BARNEY, who has for the past five years been chief electrical engineer with Messrs. Pearson & Dorman Long, Ltd., who are engaged in the development of the Kent coalfield, has been appointed local manager and engineer to the South-East Kent Electric Power Co., Ltd.

Mr. J. W. FAWCETT, electrical engineer to the Holmfirth Urban Council, who has been appointed resident engineer at Withernsea with the South-East Yorkshire Electric Light and Power Co., has been presented by the staff of the electricity department with a smoking cabinet.

At a recent meeting of the Southend Electric Lighting Committee a resolution was passed expressing appreciation of Mr. R. BIRKETT's services as tramway manager during the last 14 years. The tramways and electricity supply departments at Southend have recently been separated, Mr. Birkett remaining borough electrical engineer.

The Reigate Town Council has increased the salary of the borough electrical engineer by £25 per annum.

The Rt. Hon. Lord CONGLETON, director of G. D. Peters and Co., Ltd., Slough, has joined the board of the Park Royal Engineering Co., Ltd.

The Stoke-on-Trent Electricity Committee has considered an application from its engineer for an increase in his salary, and has recommended that it be advanced from £1,125 to £1,200, this being the maximum fixed according to scale.

Mr. V. BINGHAM has resigned his appointment as publicity manager to Messrs. Crompton Parkinson, Ltd., and is taking up a similar position in the North of England.

Mr. H. C. SPENCE, assistant maintenance engineer of the Yorkshire Electric Power Co., has been appointed engineer and manager to the Holmfirth Urban District Council electricity department. There were 66 applicants for the post.

Alderman H. J. GALLIERS, J.P., and Mrs. Galliers, the Mayor and Mayoress of Brighton, were presented with a grandmother clock as a token of good wishes on the commemoration of their silver wedding on February 24th.

In recognition of his services as hon. secretary of the Preston Corporation Electricity Sports Club, Mr. THOMAS PARKER, of the Ribble power station, who, on Saturday next, March 9th, sails for India to take up an electrical appointment at Calcutta, was entertained by the members of the club and presented with a case of electrical instruments, a gold wristlet watch, and a travelling trunk. The presentations were made by Mr. S. Wood, the power station superintendent, who was supported by Mr. R. Dickinson, deputy superintendent, and Mr. Lucas, Blackpool transmission cable superintendent.

Mr. PHILIP H. GODDARD, who has completed 25 years' service in the supply department of the British Thomson-Houston Co., Ltd., at Rugby has been presented by his colleagues and the staff and members of the branch offices with a silver salver. The presentation was made at the eleventh annual dinner of the department by the manager, Mr. J. S. Ramsden.

As a mark of appreciation of his work in connection with the development of steam turbines, the authorities of the Technical High School of Karlsruhe have awarded the degree of Hon. Dr. Engineer to Herr Gottlob Fassnacht, of Mulheim (Ruhr).

Mr. COLIN E. PROCKTER has resigned his position with the Norwich Corporation Electricity Department (Thorpe power station) to take up an appointment as electrical and mechanical engineer to the Imperial Tobacco Co. (Great Britain and Ireland), Ltd., at its works at Limbe, Nyasaland. He will sail early in April.

The Manchester Corporation Electricity Committee has appointed Mr. A. WILLIAMS, at present assistant resident engineer at Stuart Street station, to the position of assistant resident engineer at the Barton power station. Mr. C. D. MILSOM, at present engineer-in-charge, takes Mr. Williams's place at Stuart Street station.

M. Milon, chief of the French Telephone Department, has recently been appointed a Commander of the French Legion of Honour.

Obituary.—Mr. R. P. Abel.—The death occurred at Letchworth, Herts., on February 26th, of Mr. Robert Philip Abel, who, shortly before the war, joined the staff of the Union Electric Co., in London. He became assistant manager, but had to relinquish his position when the war broke out. He was sent to Russia in connection with electrical work, but succeeded in leaving that country the day before the revolution. Returning to England, he joined the firm of Kryn and Lahy, of Letchworth, and became a director. He was 41 years of age.

Mr. J. Harrison.—The death occurred suddenly on February 20th of Mr. John Harrison, who has been in business for about 17 years, as an electrical engineer and radio engineer at Lord Street, Earlestown, near Warrington. He was 42 years of age.

Mr. W. R. Spaven.—We regret to record the death of Mr. W. R. Spaven, which occurred on March 1st, at Portsmouth. Mr. Spaven retired two years ago from the post of manager of the Portsmouth Corporation tramways, which he had held for 24 years.

Dr. L. Kohlfurst.—The death is announced from Kaplitz, Bohemia, at the age of 80 years, of Dr. Ludwig Kohlfurst. The deceased was a well-known Austrian authority on railway electrification and telegraphy.

Mr. C. Dorman.—The death occurred at Middlesbrough, on February 28th, at the age of 54, of Mr. Charles Dorman, heir to Sir Arthur Dorman, Bart., and a director of Dorman, Long & Co., Ltd.

Mr. C. E. Crocker.—We regret to learn that cable advice has been received in London to the effect that Mr. C. E. Crocker, general manager of the Perth (W.A.) City Council Electricity and Gas Department, was killed in a motor accident on Monday last.

Mr. A. Brown.—Mr. Albert Brown, of Brown Bros., Ltd., passed away on March 4th after a brief illness.

Wills.—The late Sir Charles H. T. Metcalfe, Bart., who was prominently associated with many South African railway and other undertakings as an engineer, and was a director of the Victoria Falls and Transvaal Power Co., left £118,015.

Mr. J. Ferguson, M.B.E., general manager of the Perak River Hydro-Electric Power Co., Ltd., left £4,412 gross and £4,069 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

G. F. Billing & Co., Ltd.—Private company. Registered February 28th. Capital, £100 in 1s. shares. Objects: To carry on the business of electricians, mechanical and wireless engineers, &c. The subscribers (each with one share) are:—J. Bannister, 59, Chalsey Road, Brockley, S.E.4, articled clerk; R. Walter, 7, Curzon Street, N.1, clerk. Registered office: 41, Cheapside, E.C.2.

Bellfrey, Ltd.—Private company. Registered February 26th. Capital, £300 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical, telegraphic, telephonic and wireless instruments, appliances or energy, drawn wire, electric cables and lamps, and all parts and articles used in connection therewith, &c. The first directors are:—F. J. Humphrey, 15, Crescent Wood Road, Sydenham Hill, S.E.22, electrical engineer; G. C. Bell, 37, East Dulwich Road, S.E.22, electrical engineer; C. J. Laker, "St. Hilaire," 4, Blunt Road, South Croydon, chartered secretary. Registered office: 9, Brunswick Place, City Road, N.1.

Loughborough Motor Units, Ltd. — Private company. Registered February 23rd. Capital, £1,000 in £1 shares. Objects: To acquire the business of an automotive electrical engineer carried on by A. R. Faulkner at The Rushes, Loughborough, Leics., as "Loughborough Motor Units." The first directors are:—A. R. Faulkner, 3, Cumberland Road, Loughborough, electrical engineer (managing director); F. A. Parkinson, "Woodlands," Steedman Avenue, Mapperley Plains, Nottingham, traveller (both permanent). Registered office: The Rushes, Loughborough.

Lege Reet & Co., Ltd.—Private company. Registered February 25th. Capital, £8,000 in £1 shares. Objects: To acquire inventions and patents, and to carry on the business of mechanical, electrical and general engineers, manufacturers of and dealers in locomotive engines, motors, &c. The directors are:—Sir John T. Prestige, Kt., 43, Montpelier Square, S.W.7, engineer; B. W. Preston, 74, Drayton Gardens, Fulham Road, S.W.10, engineer; H. Bissell, Drayton Lodge, Frithwood Avenue, Northwood, Middlesex (director of Iron and Nickel Battery Co., Ltd.). Secretary: S. G. Nevard, 11, Aspinall Road, S.E.4. Registered office: 27, College Street, E.C.4.

Kolster-Brandes, Ltd.—Public company. Registered February 26th. Capital, £1,300,000 in £1 shares. Objects: To carry on the business of manufacturers of or dealers in any equipment, apparatus or device used in connection with any process of transmitting, receiving, producing, recording or reproducing by electrical or any other means any matter, whether consisting of sounds, images, signals, impulses or otherwise, founders, manufacturers of and dealers in machinery, metal workers, electricians, electrical and mechanical engineers, dealers in electric motors, dynamos and electrical machinery, &c. The directors are:—R. Spreckels, Burlingame, California (director and chairman, Kolster Radio Corporation); E. W. Stone, 1016, Fifth Avenue, New York City (director and president of the above Corporation); W. A. Bartlett, Romford Manor, Pembury, Kent (managing director of Brandes, Ltd.); S. W. Cole, The Turret, Sidcup (director of Brandes, Ltd.). Registered office: Cray Works, Sidcup, Kent.

Official Returns of Electrical Companies.

Worcester Electric Traction Co., Ltd.—Satisfaction in full of debentures or a charge dated March 29th, 1906, securing £15,000. (Notice filed February 22nd, 1929.)

J. L. Maughan & Co., Ltd.—Debenture dated February 18th, 1929, to secure all moneys not exceeding £3,000, charged on the company's undertaking and property, including uncalled capital (if any). Holders: Stella Conduit Co., Ltd., Highfield Works, Bilston, Staffs.

Rushden and District Electric Supply Co., Ltd.—Issue on January 8th, of £550, and on February 1st, 1929, of £450 debentures, parts of a series already registered.

Thalberg Halstead, Ltd.—Capital, £1,000 in £1 shares. Return dated January 14th, 1929. All shares taken up. £630 paid. £370 considered as paid. Mortgages and charges, nil.

Berkeley & Young, Ltd.—Capital, £22,000 in £1 shares (subdivision not stated) Return dated April 19th, 1928 (filed February 13th, 1929). 6,276 preference and 11,520 ordinary shares taken up. £7,786 paid on 6,276 preference and 1,510 ordinary shares. £10,010 considered as paid on 10,010 ordinary shares. Mortgages and charges, nil.

Halifax and Bermudas Cable Co., Ltd.—Capital, £50,000 in £5 shares. Return dated January 2nd, 1929. All shares taken up. £50,000 considered as paid. Mortgages and charges, nil.

Power and Lighting Cables, Ltd.—Capital, £10,000 in £1 shares. Return dated November 21st, 1928. 1,100 shares taken up. £1,100 paid. Mortgages and charges, nil.

Fada Radio, Ltd.—Capital, £10,000 in £1 shares. Return dated January 11th, 1929. 5,000 shares taken up. £5,000 paid. Mortgages and charges, nil.

Helio Dynamo Co., Ltd.—Capital, £20,000 in 8,000 "A" and 12,000 "B" shares of £1 each. Return dated January 15th, 1929. 8,000 "A" and 5,062 "B" shares taken up. £3,062 paid on 3,062 "B" shares. £10,000 considered as paid on 8,000 "A" and 2,000 "B" shares. Mortgages and charges, nil.

Hadden & Pearce, Ltd.—Capital, £5,000 in £1 shares. Return dated December 24th, 1928. 2,502 shares taken up. £2,002 paid. £500 considered as paid. Mortgages and charges, £1,800.

British General Manufacturing Co., Ltd.—Capital, £500 in £1 shares. Return dated November 12th, 1928. All shares taken up. £2 paid. £498 considered as paid. Mortgages and charges, nil.

Wallace Magneto Repairing Co., Ltd.—Capital, £2,000 in 800 preference shares of £1 each and 2,400 preference shares of 10s. each. Return dated October 20th, 1928. All shares taken up. £2,000 paid. Mortgages and charges, nil.

John Collier & Co. (Electrical Engineers), Ltd.—Capital, £20,000 in 12,000 "A" and 8,000 "B" shares of £1 each. Return dated November 19th, 1928. All shares taken up. £2 paid. £19,998 considered as paid. Mortgages and charges, nil.

Jersey Electric Lighting and Power Co., Ltd.—Capital, £65,000 in 51,000 preference and 14,000 ordinary shares of £1 each. Return dated August 16th, 1928. 12,257 preference and 14,000 ordinary shares taken up. £26,257 paid. Mortgages and charges, £12,000.

City Notes.

General Electric Co., Ltd.

An extraordinary meeting is called for Wednesday next, the 13th, for the purpose of considering resolutions providing for the creation of 1,600,000 new ordinary shares of £1 each, raising the company's capital to £7,600,000. It is proposed that these new shares shall be called "British ordinary shares," and shall be issued only subject to the condition that they shall not be registered in the name of, or transferable to, or held on behalf of, any foreigner, foreign corporation, or corporation under foreign control. In all other respects the shares will rank equally with the existing ordinary shares. The proposals involve a number of alterations to the company's articles of association. The notice convening the meeting was accompanied by a letter explaining that in September, 1931, the company has the option of redeeming the existing 7 per cent. debenture stock, the interest on which constitutes a heavy charge on the profits. In the directors' opinion the necessary finance can now be obtained on satisfactory terms to provide funds for this and for the general expansion of the business.

North Metropolitan Electric Power Supply Co.

Sir James Devonshire, K.B.E. (chairman) presided at the annual meeting on February 26th. In presenting the report and accounts (*vide* our last issue, p. 391), Sir James said that there had been a continuation of progress; the sales of energy had increased by 14 per cent., while the number of consumers had shown a rise of 17 per cent. At the end of the year the company had 1,294 miles of trunk and distributing mains served by 311 sub-stations. The increase in the profit appeared to be incommensurate with the growth of the business, but that was due to the further reductions in charges which had been made throughout the area; these reductions accounted for at least £40,000 during the year. Early in the current year 325,000 ordinary shares had been issued. Of these 6,250 had been reserved for subscription by members of the salaried staff. The proceeds had been devoted to paying off a bank loan. The operating results of the Brimsdown station had been satisfactory. Pulverised fuel firing was employed, and one of the two 25,000-kW turbines made by Messrs. C. A. Parsons & Co., Ltd., was believed to be the only machine of its size which generated at 33,000 V. They were making special efforts to stimulate the growth of domestic consumption of electricity. The number of consumers who had purchased their own electric cookers had more than doubled since 1926. "Electric cooking is becoming a public habit, and the rapid growth in this direction is largely due to the fact that those who have adopted electric cooking are so satisfied that, perhaps unconsciously, they become our best canvassers." There were also great advantages in electric water heating and in many other applications of electricity in the home. The company had built up an extensive organisation for the service of its consumers and for the furtherance of the matters which he had mentioned. Last year 228,000 separate accounts were rendered in connection with electricity supply, sales of electrical apparatus and for installation work carried out by the staff, representing a total revenue of over £1,000,000.

New Issues.

Kolster-Brandes, Ltd.—This company, particulars of which appear in our "New Companies" section to-day, made an issue on Monday last of 350,000 £1 ordinary shares at par. The company has acquired the business of Brandes, Ltd., and the exclusive right to exploit the inventions of the Kolster Radio Corporation (U.S.A.), and its subsidiaries, in the British Empire (except Canada) and Europe. The directors estimate that the sales for the first year will be £750,000, rising to £1,200,000 in the second year, with net profits equal to 7.3 per cent. and 13.7 per cent., respectively, on the nominal capital. It is not intended to distribute any dividends until a substantial reserve fund has been accumulated. The issue was not underwritten, the Kolster Radio Corporation having agreed to take up at par any part not subscribed.

Parent Coal Carbonisation Trust, Ltd.—On Tuesday last this company, whose nominal capital is £750,000, made an issue of 1,200,000 8 per cent. cumulative participating preference shares of 10s. each, and 1,200,000 deferred ordinary shares of 1s. each, at par. The chairman of the company is Lord Askwith, K.C.B., and the company is to exploit in this country the "Aicher" (German) process of low-temperature carbonisation of coal.

Sphinx Electric, Ltd.—The registration of this company was recorded in our issue of February 8th (p. 249). On Thursday last week the company offered for subscription at par 290,000 10 per cent. participating preference shares of 5s. each and 580,000 ordinary shares of 1s. each. The prospectus stated that the preference shares would participate to the extent of 25 per cent. of the surplus profits after the payment of 10 per cent. on the ordinary shares. The company is acquiring the businesses of Auto-Bulbs, Ltd., and Sphinx Electric Supplies (Ireland), Ltd., for £88,000 (£47,000 in cash and the balance in shares). It expects to have a working capital of £42,000, and is to manufacture automobile lamps, an accumulator-regenerating compound, a fog dispeller, &c. The gross profits of the two companies acquired (*i.e.*, excess of net sales over net purchases) have been as follows:—1924, £11,926; 1925, £13,205; 1926, £17,638; 1927, £22,135; 1928, £13,445. Although several of the London newspapers described the investment as speculative the lists were closed on Friday last owing to over-subscription.

Underground Electric Railways Co. of London, Ltd.

The accounts for the year ended December 31st record a total income of £1,153,798, an increase of £188,952 over the 1927 figure. The expenses amounted to £68,277 (£11,724 decrease), leaving net receipts of £1,085,521 (£200,676 increase). After meeting interest on the debentures and bonds, adding a net amount of £169,761 brought forward, and writing off £10,000 from commission, discount, &c., a balance of £709,401 (£286,196 increase) is carried to the balance sheet. The ordinary dividend (as already reported) is 7 per cent. for the year (against 5 per cent.), and £262,504 remains to be carried forward. During the year £4,000,000 of 5 per cent. first mortgage debenture stock was created and sold. The proceeds were used to repay bonds and loans, &c., and there was a balance enabling the company to widen the scope of its investments. The report reviews the operating results of the companies in which investments are held, and points out that during the year the operating companies spent £2,164,000 on various improvements and additions. Reference is made to the Bills for the co-ordination of London passenger transport services and to other Parliamentary measures. The report also records the retirement of Major-General Sir Frederick Sykes from the board and the appointment of Mr. F. Pick as a director. The meeting was to be held yesterday (Thursday).

Charing Cross Electricity Supply Co., Ltd.

The directors' report for the year ended December 31st, 1928, shows that the West End Undertakings had gross earnings amounting to £330,571, against £337,839 in 1927. The net earnings rose from £121,030 to £145,920. A net balance of £34,966 brought forward and interest and dividends of £57,608 are added, making £238,494. After providing for debenture interest, sinking fund, preference dividend and "standard" ordinary dividend, £79,706 remains to be carried forward. The total connected load is now 34,533 kW; the sales of energy during the past year totalled 28,599,840 kWh.

The City Undertaking's accounts show gross earnings of £345,939 (against £354,527), and a net income of £137,288 (£100,414). A net balance of £1,472 brought forward is added, together with rent in respect of Bow generating station, &c., £60,944, making £199,703. After providing for debenture interest, &c., and preference dividend, ordinary dividends of 10 per cent. on £380,000, and 7 per cent. on £200,000 are paid, leaving £18,227 to be carried forward. The connected load is now 41,332 kW, and the sales during the past year totalled 36,270,027 kWh. The meeting was held on Wednesday last.

Metropolitan Electric Cable and Construction Co., Ltd.

The second annual report (for the year ended December 31st last) showed a trading profit of £24,086. After providing for expenses, depreciation, income tax, &c., and adding £819 brought forward, there was an available balance of £6,726. A dividend of 7½ per cent., free of tax, is being paid, and £2,000 is set aside to form a general reserve, leaving £976 to be carried forward. The death of the chairman (Mr. D. D. Warren) is recorded. At the annual meeting on February 22nd, Mr. J. Miller occupied the chair, and, after referring to Mr. Warren's death, said that the directors were pursuing a conservative policy with regard to the profits. They expected the erection of the new building to be completed by the end of June. Certain plant had been ordered, but they were going very cautiously in the ordering of other plant, in order that they should have the latest type of machinery and the most up-to-date factory for production at lowest cost. The outlook for 1929 was very promising, and he felt sure that when the new factory was completed, and with the programme they had in hand for still further improvement of the type of cable that they intended making, they would soon realise the position which they had set out to achieve.

London and Suburban Traction Co., Ltd.

The annual meeting was held on February 26th. Lord Ashfield (chairman), who presided, said that traffic had improved considerably, the number of passengers carried having increased by 12,000,000 to 193,000,000. Referring to the proposals submitted to Parliament by the London County Council and the Underground Group of companies for the co-ordination of the passenger transport facilities within the London Traffic Area, he said that neither by sectional measures nor by competitive methods could London be provided with adequate transport facilities at the lowest cost, which in other words was the lowest fare. Only by a common management capable of surveying and planning to cover the whole field of transport, and by a common fund capable of equalising the financial burdens and gains for all interests, could undivided attention be given to fulfilling the purposes of a transport system which was to meet the needs of the passengers; only by such means could a margin of resources be secured which would allow of the steady expansion of the facilities provided.

St. James' and Pall Mall Electric Light Co., Ltd.

The annual meeting was held on February 27th, Mr. G. W. Balfour (chairman) presiding. In presenting the report (*vide* ELEC. REV., February 15th, p. 296), Mr. Balfour said that the output of electrical energy in 1928 amounted to over 32 million kWh, against 28 millions in 1927, and the connections increased from 31,733 to 35,626 kW, an increase of 12.27 per cent. The initial charge for lighting supply was, from Midsummer last, reduced to 4d. per kWh, with a reduction to 3d. per kWh for any excess over a consumption of 4,000 kWh per annum. The power charge was also reduced to a flat rate of 1d. per kWh, and a special rate of ½d. per kWh was introduced for water heating during off-peak periods. The introduction of a rate of 2d. per kWh for shop-window lighting during certain hours had proved a success. Lord Wargrave was elected to the board to fill the vacancy caused by the death of Sir Alexander Kennedy. The report and accounts were adopted.

Mather & Platt, Ltd.

The annual meeting was held on February 27th, Mr. L. E. Mather (chairman) presiding. In presenting the report and accounts (*vide* our last issue, p. 392), the chairman said that it was satisfactory that the profit had shown a slight increase in view of the difficulties of the past year. They had continued to improve their production methods, and their research department and designers had produced increasingly good results. They had further developed the standardisation of their dynamos and motors, which had resulted in increased sales. In the pump department their improved designs had met with gratifying success. Pumping units for power-station work had been designed and manufactured for the highest pressure and largest capacity of any in Europe. The outlook both at home and abroad appeared to be brighter. He claimed that few engineering firms gave so much attention to the development of overseas trade as their company did.

Chatham and District Light Railways Co.

The revenue for 1928 was £67,025, as compared with £72,362 in 1927; the gross working balance was £8,548, against £13,722. After meeting rental and taxation and crediting interest received and £1,259 brought forward, there is a balance of £5,412, which it is proposed to carry forward. The directors state that the revenue during the past year again showed a decrease due to intense competition, and they regret that they are unable to pay a dividend on either the preference or the ordinary shares. Last year the ordinary dividend was 2½ per cent. As we have already reported, the company is applying for Parliamentary powers to substitute omnibuses for its tramway system. Meeting: March 11th.

Westminster Electric Supply Corporation, Ltd.

Speaking at the annual meeting on February 27th, the chairman (Lord Wargrave) said that the cost of electricity purchased was £7,000 higher, but this had been counterbalanced by an increase in output of 5¼ million kWh, with an increase in revenue of £11,000. The change of the company's system of supply from d.c. to a.c. continued to make satisfactory progress, and the benefit was already being felt by an increase in efficiency during the year which resulted in a saving of 600,000 kWh. Referring to the electricity charges, he said that the standard prices applied to the figures for the years 1926, 1927 and 1928, showed that consumers had received benefits in these years totalling £188,787.

Celestion, Ltd.

This company on Monday this week published, for information only, a statement of its constitution and objects. It has a nominal capital of £400,000, of which £253,007 has been issued in the form of 103,007 7½ per cent. cumulative participating preferred ordinary shares of £1 each, and 600,000 deferred ordinary shares of 5s. each. The company was formed in December last to acquire the business of the Celestion Radio Co., and to manufacture radio and kindred apparatus. The purchase consideration was £54,000 in cash, 400,000 deferred ordinary shares and the payment of the Celestion Company's liabilities on November 16th, 1928.

Torquay Tramways Co., Ltd.

At the annual meeting on February 27th, Mr. H. T. Barnett (chairman), in moving the adoption of the report and accounts, referred to the question of the relationship of tramcars and 'buses with railways, and said that if the managers of railways and other transport services were allowed by the public to keep their heads, there would during the next few years be co-operation between the services to the immense advantage of travellers, as there was no doubt that one set of services was complementary and not antagonistic to the other.

Liverpool Overhead Railway Co.

The revenue account for 1928 shows total receipts of £97,493 (against £93,558) and an expenditure, including £4,400 to reserves, of £79,610 (against £83,200). The surplus was thus £17,883, as compared with £3,603 in 1927. After meeting debenture interest and crediting £534 brought forward, a dividend at the rate of 5 per cent. is to be paid on the preference shares, leaving £3,730 to be carried forward. The number of passengers carried rose from 7,328,176 to 7,511,559.

Lancashire United Transport and Power Co., Ltd.

In the course of his speech at the annual meeting on February 28th, Sir Arthur Stanley, G.B.E. (chairman), said that owing to short-time working at some of the cotton mills the sales of power had slightly decreased. Throughout the country tramway undertakings were being seriously affected by the bad state of trade. The company had also suffered from the competition of motor-omnibuses and the time had come when the renewal of the track had to be considered. The directors therefore considered it desirable to abandon the tramways and substitute either trackless trolley vehicles or omnibuses. A Bill was being promoted in the present session of Parliament to give effect to this arrangement.

Beauly Electric Supply Co., Ltd.

This company recently applied to the Ministry of Transport for a Special Order which would make it a statutory undertaking and prevent the Grampian Company coming into its area and competing with it. At the annual meeting of the company held on February 26th, Mr. E. J. Williams, M.I.E.E., presided. For the eighth year in succession a dividend at the rate of 10 per cent. was declared. The chairman intimated that as a result of the application for a Special Order the directors had received an offer from the Scottish Power Company, Ltd.—one of the Grampian group—for the whole of the £1 shares at 35s. per share. This offer the directors had carefully considered and the shareholders would be recommended to accept it.

Enfield Cable Works, Ltd.

The directors report a profit of £142,000 for the eighteen months ended December 31st last and recommend a final dividend of 10 per cent. on the ordinary shares, making 30 per cent. for the period. They also proposed to raise the company's authorised capital to £800,000 by the creation of 350,000 ordinary shares of £1 each. Of these 100,000 will be offered to the present shareholders at 40s. per share in the proportion of two to each five shares already held. Meeting: March 20th.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

West Gloucestershire Power Co., Ltd.—£50,000 5½ per cent. first mortgage sinking fund debenture stock.

Yorkshire Electric Power Co.—897,000 ordinary shares of £1 each fully paid, Nos. 1,603,001 to 2,500,000, and 20,000 6 per cent. cumulative preference shares of £1 each fully paid, Nos. 1,603,001 to 1,623,000.

North Wales Power Co., Ltd.

The resolution for the reduction of the company's capital from £1,000,000 to £808,058 10s. having been passed on February 22nd, a further extraordinary meeting is called for March 11th to approve the other proposed arrangements which were outlined in our issue of February 22nd (p. 344). These include the sub-division of the preference shares and their conversion into ordinary shares; and the restoration of the capital to £1,000,000 by the creation of 383,883 10s. ordinary shares.

Brown Bros., Ltd.

In the course of his speech at the annual meeting on February 26th, the chairman (Mr. E. Brown) said that the radio business was becoming more stabilised. They had suffered during the past year from all-round reductions of prices. The position with regard to design was now more settled, and the remarkable improvement and lower cost of receiving sets should lead to a largely-increased demand.

Wellingborough Electric Supply Co., Ltd.

The total revenue for the past year was £19,089, and after making provision for depreciation, debenture interest, &c., there was a profit of £1,874, to which was added £2,066 brought forward, making £3,940. It is proposed to pay a dividend of 5 per cent., leaving £1,690 to be carried forward. The sales of energy rose from 1,285,802 to 1,539,804 kWh.

Chas. Clifford & Son, Ltd.

From the 1928 net profit of £14,326, plus £53,247 brought forward, the directors propose to pay a final ordinary dividend at the rate of 10 per cent. per annum and a bonus of 5 per cent., both free of tax. £12,000 is placed to the reserve for the renovation of plant, machinery, &c., and £44,773 is carried forward.

Bell Telephone Co. of Canada.

This company reports a net profit on last year's working equivalent to 10.14 per cent. on the capital stock, as compared with 9.69 per cent. for 1927. The surplus of the company is now $5,269.000, an increase during the year of $931,000.—*Reuter* (Montreal).

Wisbech Electric Light and Power Co., Ltd.

The gross profit for the past year was £7,636, and to this is added £1,782 brought forward, making £9,418. After providing for depreciation, renewals, reserve and preference dividend, the directors propose to pay 10 per cent. on the ordinary shares and to carry forward £2,585.

Marconi International Marine Communication Co., Ltd.

The gross revenue and receipts of the company for the year ended December 31st last amounted to £905,816, as compared with £912,640 in the preceding year; the net profit rose from £179,730 to £193,420. The directors recommend a final dividend of 7½ per cent., making 15 per cent. for the year, against 12½ per cent for 1927. A balance of £36,889 is carried forward, against £13,011 brought in. The report states that the investments, standing at £514,561, show a decrease of £99,943; this decrease is mainly offset by an increase of shares in a foreign associated company. During the year Mr. F. S. Hayburn was appointed a director. Meeting: March 11th.

Canadian Power Loan in New York.

The Power Corporation of Canada, Ltd., which controls a number of leading Canadian electric power companies, is raising a loan of $10,000,000 in New York by means of 4½ per cent. 30-year convertible debentures.

English Electric Co., Ltd.

The directors announce that the financial results of the past year do not admit of the payment of a dividend on the preference shares. The dividend on these shares is in arrear as from June 30th, 1926.

Calgary Power Co.

The gross operating earnings for 1928 were $949,422, against $494,408 in 1927, while the net income rose from $129,594 to $251,198. The preferred stock dividend absorbs $25,000, and the common stock dividend $102,500.

Vickers, Ltd.

The directors have declared the final dividends on the preferred stock, the preference shares, and the cumulative preference shares for the half year ended December 31st last, amounting to 2½ per cent. in each case, tax-free on the last class.

Crompton Parkinson, Ltd.

The interim dividend on the ordinary shares for the six months ended December 31st, 1928, is at the rate of 22½ per cent. per annum.

Telegraph Construction and Maintenance Co., Ltd.

The directors recommend a final dividend of 7½ per cent., free of tax, again making 10 per cent., tax free, for the year.

Western Telegraph Co., Ltd.

A dividend of 5s. per share, free of tax, has been declared in respect of the quarter ended December 31st, 1928.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The directors recommend a final ordinary dividend of 3½ per cent., making 6 per cent. for the year, as for 1927.

Stocks and Shares.

Monday Evening.

Stock Exchange conditions have taken on a much quieter tone than has prevailed for some time past. For this, the principal reason is the money situation: first, in New York, and then on this side; while the second factor which looms largely in the situation is the shadow of the forthcoming General Election. It will be, unfortunately, needful to refer to both these factors for some time to come. Political considerations are bound to exert a good deal of influence in the stock markets. The fear is, of course, that Labour may secure a majority large enough to enable extremists in that party to launch schemes that may be regarded as predatory and fantastic, aimed at the security of capital, and devised for the purpose of increasing taxation upon companies, corporations and individuals who are even now taxed with sufficient heaviness. The main issue of the Election is expected to focus upon the tariff policies of the parties, though how these will appeal to the susceptible heart of the flapper-voter, eager to record her vote for the novelty of the experience, only the ballot-boxes can demonstrate.

Cable and Wireless.

One department in which weakness is somewhat marked is that for cable stocks and shares. Falls have taken place in Eastern Telegraph, Eastern Extensions, Westerns, Great Northerns, and Anglo-American deferred. The heaviness in the Eastern quartette was ascribed by some people to the new invention, claimed by the Beam system, of simultaneous telegraphic and telephonic communication between here and Canada. But it may well be doubted whether this consideration had anything to do with a heaviness that can be more properly attributed to the depressing effect of the money market. Stock Exchange members have been talking about the possibility of a 6½ per cent. Bank Rate, and maintaining that, if the rise does not come on the Thursday in this week, its advent is likely to prove merely postponed. Everything must depend, of course, upon the position of money in America, where the key to the present position rests for the moment.

Marconi shares have gone back to £4, and a sharp fall occurred in Marconi Marines, on the dividend announcement making only 15 per cent. for the year. Most people had been expecting some sort of bonus, and the declaration was followed by a fair amount of selling. Canadian Marconis, on the other hand, have strengthened to 34s., support coming from New York, as well as from Montreal. Burndepts are 6s. middle. International Telephone and Telegraph, after being 225, went back to 220. The American Telephone and Telegraph Company, in its annual report, mentions that plans have been made to lay a special telephone cable across the Atlantic.

Central Electricity Board Contracts.

Speculation in the shares of the London electricity supply companies has subsided, not even County of London being the object of any particular animation during the past week. The quotation is steady at 53s., but Bournemouth and Poole, upon the strength in whose shares the rise in County of London was partially based, have gone back to 69s. 6d. Electric Supply Corporations are a little lower at 56s. 3d. Amongst the profvincial shares, Midland Counties lost 1s. at 29s. 6d. The Chairman of the Central Electricity Board, speaking at the British Industries Fair, Birmingham, announced that the Board had already placed contracts for over three million pounds sterling, and that in the week following, the Board intended to place other contracts for a similar amount, all of them in this country. The money, he added, was not being spent light-heartedly, but with a feeling that it was absolutely necessary that the schemes they favoured should ultimately pay their way.

London Electric Shares on Offer.

It may be of service to mention that there are at the present time on offer 1,000 Brompton and Kensington Electric ordinary shares at 27s. These pay £6 7s. 9d. on the money, on the 8½ per cent. dividends at present declared, but the yield on the 7 per cent. basis, to which the shares will probably revert in 1931, is shown in our lists. There are also 1,000 City of London Electric Lighting ordinary shares obtainable at 33s. 6d., and paying £5 19s. 3d. until 1932, using as a basis the 10 per cent. dividend which the company is at present paying on these shares. The substantial line of 5,000 St. James' and Pall Mall Electric Lighting ordinary shares is on offer at 27s. 9d., cum dividend. The company is paying a trifle under 8 per cent. dividends until 1931, and on this figure the yield is £5 13s. 9d. per cent. on the money. A line of 5,000 Westminster ordinary can also be obtained, the price in this case being 27s., and the yield, until 1931, 6½ per cent., calculated on the 8.8 per cent. dividends paid annually during the past three years. A fair number of South London Electric ordinary at 27s. 6d. will give £6 3s. 6d., and Kensington and Knightsbridge at 27s. 6d. will pay £5 16s. 3d., with the same proviso in regard to the year 1931, when the new arrangement comes into force. There are 500 Chiswick Electric ordinary available at 67s., to pay 4½ per cent.

Provincial Power and Supply.

In the provincial group, a couple of thousand Midland Counties ordinary at 29s. 3d. pay £4 8s. 9d., 5,000 Newcastle-on-Tyne ordinary at 26s. return £4 12s. 3d. per cent., and the same yield is available from 2,000 Northampton Electric Light and Power ordinary shares at 39s., all the last three named being cum the dividends which may be taken off the prices before these paragraphs appear. Two thousand Altrincham ordinary at 61s. 6d., yielding £6 16s. 6d., and the same number of deferred shares in this company at 18s. 6d., affording a return of £7 18s. per cent. on the money, can be obtained;

and in Bournemouth and Poole, 500 shares are on offer at the time of writing at 71s. The Newcastle-on-Tyne Electric Supply Company has notified its dividend, making 6 per cent. for the year 1928. The report should be available next week, and is likely to show good figures. The Lancashire United Transport and Power Company proposes to substitute railless trolley cars for its present tramway system. The company's 6 per cent. first debenture stock is quoted at 97, and the ordinary shares stand at 10s.

The Undergrounds and Petrol.

Increase in the price of petrol led to an abrupt fall in Underground Electric Railways of London incomes, where the price of 115 is about 4¼ points down, allowing for deduction of the half-yearly interest payment. The London General Omnibus Company is considered likely to be very unfavourably affected, and the question of increased fares is said to be under discussion. Underground shares fell 6d. to 25s. Districts remain unchanged at 80½. but Metropolitan consolidated at 63½ is 1½ lower. Traction and tramway shares of the British companies have undergone no change. London and Suburban Traction preference remain dull at 12s. British Electric Traction deferred stock holds its last week's gain of 100 points.

The Anglo-Argentine group is irregular, an eighth gain in the first preference shares being balanced by a loss of 2 points in the 5 per cent. debenture stock, lowering the latter to 75. Brazilian Traction common shares at 70½ are half a dollar down on the week.

Atlas and North Wales.

Atlas Light and Power ordinary shares strengthened to 30s. upon a rumour that the company had resolved to sell its Montevideo interests. The report lacked confirmation, but the shares remained in request from New York. There are a few thousand of the company's 7 per cent. preference shares on offer at 24s. These yield £5 16s. 8d. per cent. on the money, dividends being due in May and November. A meeting is to be held next Monday, March 11th, of the North Wales Power Company, for the passing of resolutions which arise out of the proposals to reorganise the capital. It is also announced that Messrs. Robert Benson & Co. have agreed to subscribe for the 859,177 shares of 10s. each which, previously, the firm was going to underwrite. The company's 4½ per cent. guaranteed debenture is a Trade Facilities Act stock, the price standing at 96. The ordinary shares change hands occasionally at about 12s.

Dollar Stocks.

Amongst the dollar stocks and shares on offer which are not quoted in our price lists may be mentioned British Columbia Power Corporation "A" shares of no par value, in receipt of 2 per cent. dividends, which at 58 yield £3 9s. per cent.; Calgary Power common shares of $100 each, receiving 5 per cent., and at 180 offering a return of 2¾ per cent. on the money. Canadian General Electric 7 per cent. preference are of $50 each, and at 61 yield 5¾ per cent. Columbia Gas and Electric shares (new) at 154 return 3¼ per cent. on the basis of the last-paid 5 per cent. dividend, and Consolidated Gas, Electric Light and Power of Baltimore common shares, in receipt of 3 per cent. dividends, return at 105—the current quotation—2¾ per cent. on the money. Middle West Electrics 7 per cent. prior lien shares at 135 give £5 18s. 6d. on the basis of the 8 per cent. dividend, and the common shares, which receive 7 per cent., stand at what looks to be the high price of 185, yielding 3¾ per cent. on the money. Montreal Light, Heat and Power Co. shares at 117 return a slender £2 2s. 3d. per cent., which is about 2d. more than the income derivable from Pennsylvania Water and Power common shares at the current level of 95. Compared with these returns, that of £2 4s. per cent. on Shawinigan Water and Power common shares looks quite good. This company also pays 2 per cent. dividends, the price of the shares being about 91.

Manufacturing Shares.

Amongst the manufacturing shares, Enfield Cables ordinary attracted attention by reason of a proposal, contained in the annual report, for the issuing of 100,000 new shares at 40s. in the proportion of two new shares for every five shares held. The company has declared a final dividend making 30 per cent. for the year, as compared with 20 per cent. for the previous twelve months. As the price of Enfield ordinary stands at 5¼, there is a handsome bonus contained in the offer. Callenders have gone back to 4¼; International Automatic Telephones are easier at £2. Henleys are a little lower at 6, and General Electrics at 3¼. Siemens lost ½ at 27s. 6d. Ever-Ready shares, after being 24s. 6d., subsided to 23s. The Sphinx Electric offer of 290,000 preference shares of 5s. each at par, and 580,000 ordinary shares of 1s. each, was oversubscribed. In the iron, steel and engineering section, the general disposition was to put up prices on the impression that both the Unionists and the Labour Party are toying with the proposal to extend the principle of "safeguarding" as applied to some of the basic industries of the country. Vickers rose nearly 1s. to 12s. 3d., but eased off to 12s. Babcock and Wilcox are unchanged, and, in the depression which crept over the markets in consequence of the monetary situation, other improvements that had occurred were wiped out.

The rubber share market keeps steady, the price of the produce holding to a little over 1s. per lb.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1926.	1927.	Price March 4 1929.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole	1	14†	15	69/6	—½	... ...
Brompton Ordinary	1	8⅝	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 5 5
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅝	8⅝	27/-	—	5 8 8
City of London	1	10	10	32/-	—	6 7 6
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	2	—	4 2 6
County of London	1	7½	7½	53/-	—	2 16 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	11	56/3	—9d.	3 18 2
Kensington Ordinary	1	8	8	27/-	—	5 8 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	27/6	—	5 1 10
Metropolitan	1	8	9	2¼	—	4 0 0
do 4½% Pref.	1	4½	4½	17/6	—	5 3 10
Midland Counties	1	6	6½	29/6	—1/-	4 8 8
Mid. Elec. Power	1	—	15	2⅛	—	... ...
Newcastle-on-Tyne Ordinary ...	1	5	6	26/8	—	4 11 8
do. 7% Pref. ...	1	7	7	26/6	—	5 5 8
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	34/-	—	4 14 8
South London	1	8½	8½	27/6	—	5 1 0
Urban Ordinary	1	7	7	44/6	—	... ...
Westminster Ordinary	1	8½	8½	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	24/9	—	6 1 8
Yorkshire Elec.	1	8	8	36/-	—	4 9 0

†4% of which was tax free.

Home Rails.

Central London Ord. Assented ...	Stock	4	4	73xd	—1	5 11 1
Metropolitan	,,	8	8	63½	—1½	5 10 3
do. District	,,	8½	4	80½	—	5 4 8
Underground Electric	£1	1½	5	25/-	—6d.	5 12 0
do. do. Income ...	Bonds	6	6	115xd	—4½	5 4 4

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	108	—	5 16 6
do. Def.	,,	1½	1½	24½	—½	6 3 9
Automatic Telephone	1	10	10	2½	—	4 14 1
Eastern Extension	10	10	10	2 ⅛	—½	*3 16 7
Eastern Tel. Ord.	Stock	10	10	269½	—2	*3 16 9
Globe Tel. and T. Ord.	10	10	10	26⅜	—	*3 15 9
do. do. Pref.	10	6	6	11½	—	5 9 6
Great Northern Tel.	10	20	20	22½	—½	... ...
Indo-European	25	10	10	55½	—	*4 10 9
Marconi	10/-	5	*10	4	—⅛	... ...
Marconi-Marine	1	8⅜	19½	9⅜	—½	4 8 9
Oriental Telephone Ord.	1	12	12	3	—⅛	... ...
Western Telegraph	10	10	10	25⅝	—½	8 17 2

*Interim.

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅝	+⅛	7 1 11
do. do. 2nd. Pref. ...	5			8½	+⅜	7 12 4
do. do. 5% Deb. ...	Stock	5	5	75	—2	6 13 4
British Electric Traction Def. Ord.	,,	—	—	925	—	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 9
Brazil Traction	100	6	7	70½	—½	2 17 8
Brit. Colombia Elec. Rly. Pcs. ...	Stock	5	5	96⅛	—	5 5 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	12/-	—	... ...
London United Tram Deb. ...	Stock	4	4	61	—	6 11 4
Mexico Trams, 5% Bonds	—	5	5	82	—1½	5 15 0
Mexican Light Common	100	Nil	Nil	91	—1	... ...
do. 7% Pref.	100	Nil	7	77½	—	9 0 8
do. 1st Bonds	—	5	5	£0	+1	6 5 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	18	15	8½	—	*4 11 5
British Aluminium Ord.	1	10	10	46/3	—1/6	*4 6 7
British Elec. Transformer Pref....	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4½	—	8 8 8
Brush Ord.	1	10	10	28/9	—	6 19 2
Callenders	1	15	15	4¼	—⅛	8 10 9
do 6½% Pref.	1	6½	6½	1½	—	5 4 0
Crompton Parkinson Ord.... ...	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/9	—	6 4 3
Edison-Swan 1st. Pref.	1	7½	7½	25/9	—	7 1 2
do. 5% Deb.	Stock	5	5	66½	—	5 15 7
Electric Construction	1	7½	7½	1⅞	—⅛	7 1 2
Enfield Cable Ord.	1	20	20	5⅛	+⅛	5 9 1
English Electric	1	Nil	Nil	8/3	—6d.	... ...
do. do. Pref	1	8	Nil	9/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/6	—	5 6 1
do. Ord.	1	7½	10	3½	—⅛	3 1 6
Henley	1	25	25	6	—⅛	4 1 8
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	11/8	—	... ...
Johnson & Phillips	1	12½	10	14⅝	—	5 8 1
Siemens Ord.	1	7½	7½	13	—½	5 9 1
Telegraph Construction	12	10	10	25½	—	*4 15 8

*Dividends paid free of Income Tax.

The British Industries Fair.—IV.

Functions and Exhibits in London and Birmingham.

WHEN dealing with the British Industries Fair during the past few years we have always, with reason, laid greater stress upon the Birmingham Section for it is there that the electrical manufacturers are most in evidence. But gradually the London Section has assumed greater electrical importance and this year we have been compelled to give it more space than ever before. It may be that the Southward movement of industry has had an influence in this direction, but whatever the reason may be there is no doubt that the manufacturers of the smaller electrical apparatus and appliances were well represented at the White City this year.

The Fair closed on Friday last week, and by all accounts the business done was very gratifying. It always has to be borne in mind that the immediate results of such an exposition are by no means the *only* results. Shy or cautious buyers often prefer to make notes of what they have seen with a view to placing orders at a later date, so that the ultimate effect of the Fair is really incalculable. Another thing which has to be considered is the way in which such excellent shows enhance the prestige of British industry generally in the eyes of foreign and Dominion buyers.

seven months in advance of this year's Fair in Birmingham every foot of space was let. For this Fair there were 300 manufacturers on the waiting list, all of whom had to be refused space. I am satisfied in my own mind that the Fair is well on its way to establishing itself as one of the greatest practical assets to British production that has ever been created. It is becoming recognised as the annual trade event which wholesale and retail distributors must take into account as the guiding factor in making their plans for the year. This view of the inevitable development of the British Industries Fair is confirmed by the official visit which I paid to the White City Section in London. The Fair, as a whole, has taken deep root. Both sections together form a complete exposition of the industries which make up our productive earning capacity as a nation. In 1930, we are all looking forward—exhibitors, buyers and management—to a still more remarkable record of business."

A director of one of the most prominent exhibitors of a specialised line of electrical apparatus informs us that his company never had fewer than 25 or 30 sound electrical men at its stand on any day of the Fair, and these came from all over the country. He is of the opinion

Edison Swan Electric Co., Ltd.

George Bray & Co., Ltd.

Two of the Stands at Castle Bromwich, Birmingham.

The following statement on the achievements of the Birmingham Section of the Fair was made by Mr. R. C. Rodgers, president of the Birmingham Chamber of Commerce, which is responsible for the management of that section, at the close on Friday night: "I do not think it can be questioned that the Fair this year has been the most successful of the series. During the past eleven days I have been in close contact with a large number of exhibitors, and have obtained much information. Upon that information I have formed the definite opinion, which is confirmed by my colleagues on the Fair Management Committee, that the amount of actual business done has been entirely satisfactory, and that the number of trade inquiries has been largely in excess of last year. Already many of the exhibitors have applied for increased space for 1930, and everything points to the fact that the exhibition buildings must be still further extended. What the extent of the increased accommodation will need to be depends on the exhibitors themselves, but it is of the first importance that they should make their demands known at the earliest possible moment. The Chamber of Commerce has willingly faced extensions costing £30,000 in each of the last two years. The Chamber is prepared to make adequate provision for space in 1930, but I would point out that

that even in its present form the Fair is doing a great deal of good, but it could do enormously better if it were thoroughly representative of the industries of the country attracting foreign buyers, and if every detail of its organisation was as perfect as it might be.

The difficulty with regard to the Electrical Section is, as we pointed out last week, the immense variety of the productions of some of the leading manufacturers. Any attempt at strict classification would involve some companies in dozens of exhibits ranging from lamps to heavy machinery. At the same time it is probably true that the bulk of the firms exhibiting are more or less specialists in a particular direction, and so far as these are concerned some sort of co-ordination might well be tried.

We suppose that a large number of the buyers who visit the Fair are on the look-out for some individual appliance, accessory or apparatus, and it would certainly be more convenient to them and more conducive to business if they were able to find their particular class of product in a definite quarter.

No doubt this problem has already been placed before the management and will receive careful consideration.

In this issue we publish the concluding instalment of notes upon the stands at London and Birmingham.

Electrical Organisations at Birmingham.

An Important Statement by Sir Andrew Duncan.

THE attendance at the Birmingham Section of the Fair on Friday last (the concluding day) was very satisfactory. Similarly to the preceding Friday it was an "electrical" day. Delegates were present at luncheon, as the guests of the Birmingham Chamber of Commerce, from the following bodies:—The Institution of Electrical Engineers, the Association of Consulting Engineers, the Association of Supervising Electrical Engineers, the Electrical Contractors' Association, the Electrical Contractors' Association of Scotland, the Electrical Wholesalers' Federation, the Electrical Merchants' and Manufacturers' Association, the Association of Mining Electrical Engineers, and the Illuminating Engineering Society.

Mr. G. N. Guest (chairman of the Fair Management Committee), who presided, stated that the Chamber of Commerce recognised that the electrical industry was the key to nearly all other industries. If this did not yet apply to all of them, it would be so when the "grid" arrived and then he hoped electricity would be much cheaper. Perhaps Sir Andrew Duncan would refer to that possibility if he dared (laughter). All present depended upon industry and the Fair was a big effort on the part of manufacturers to promote British trade and therefore British industry. He hoped, moreover, that the Fair would lead to increased business in the international markets. He trusted that with the growth of the Fair, which was inevitable, the Government would make a grant of much more than the £25,000 which it allowed at present, for advertising the two sections of the Fair.

Sir Andrew Duncan's Speech.

The toast "The Success of the Electrical Industry" was proposed by Sir Andrew Duncan, Chairman of the Central Electricity Board, who said that they all recognised that it was a far cry from the old time Fairs of the early craft fathers, who had their own exhibitions of their own handicraft in their isolated communities, to a great national Fair of British industry such as had been organised in Birmingham. The same stimulus to creative enterprise and the same enlargement of commercial vision arose to the nation from a Fair like that as arose to those small communities in olden times. It was fitting that the electrical industry should take such a leading part in that exhibition of British manufacturing strength. Many of our older industries had been going through a depressing time, and in spite of the superficial criticisms levelled against the internal disorders of industry that had arisen, or were supposed to have arisen from the superfluous and post-war booms, fundamentally the trouble had been that these industries which built up great facilities and led the world before the war, had had to-day too many facilities at hand for the market that was available. But the electrical industry had been like the younger brother in the family. Its strength was now growing rapidly in outlook and outlet; domestically and industrially the country was beginning to look more and more to this younger brother. It was, perhaps, natural that he should regard the electrical industry from the angle from which they of the Central Board must approach it. The trouble of the Act of 1926 had now died down and they were able to see things in a better perspective. Whether the expediency of cheapness would be realised or not the electrical industry ought, he thought, to be grateful to those politicians who, two years ago, gave the electrical industry better propaganda, if less truthful, than usual (laughter). It was better propaganda than the Electrical Development Association could have done in ten years, great as had been that Association's work. The public had been trained now to look to the electrical industry, and having launched their fifth scheme as a Board, and having visited almost every undertaking in five great areas, he was able to say of his own knowledge that there was a combined determination on the part of electrical engineers running power stations and distribution systems to expand to the greatest possible degree the use of electricity. And with a slight revival of British industry there would be unquestionably a growth of the use of electricity in this country that would more than surpass what they regarded as the very optimistic estimates made by gentlemen in London.

Further Central Board Contracts.

On the manufacturing side, too, both in the production of apparatus and of the larger type of machinery, the work that arose from the 1926 Act was now beginning to tell. Already the Central Board had placed contracts for over £3,000,000, and in the next week it intended to place contracts for another £3,000,000. All those contracts had been placed in this country, and those to be given out next week would also be placed in this country. He did not want anybody to say that they were spending that vast sum with a light heart. They were doing it with a great degree of responsibility, feeling that it was necessary for the schemes if they were ultimately to pay their own way. The view of the Central Board was that the electrical manufacturing industry had applied its energies in an equitable and fair manner from the monetary point of view to see that the requirements of the Central Board had been met on a basis that would ultimately make these paying schemes. There was an indirect reaction in this new experience of high-voltage transmission lines in the country. It was giving their own manufacturers a market at their own doors from which they would gain experience in the type of work which was world-wide now, and in world-wide competition they would be able to compete assisted by the knowledge gained at home. That he believed was regarded by the manufacturing industry of prime importance. He believed there were some important accessories which had always been manufactured abroad and imported into this country. We had already a movement for establishing factories here, not only for making them for our own market, but for the purpose of competing in foreign markets.

Engineers and Salesmanship.

Lieut.-Col. K. Edgcumbe (President of the Institution of Electrical Engineers), in responding, remarked that there were those who held that a technical institution like theirs should restrict itself to purely technical questions and pay no attention whatever to the industrial side. To his mind that was entirely wrong. The engineer was met at every turn with industrial questions. In fact, the success of the engineer depended more than anything else upon the price at which he could do his job. The Prince of Wales in his recent speech made some pertinent remarks on salesmanship. He believed a certain number of people thought that our salesmanship was not so black as it was painted. Be that as it might he thought they must agree with what the Prince said, that successful salesmanship depended largely upon personality and an intimate knowledge of the goods that were being sold. He felt that in a technical industry such as the electrical industry, it was quite impossible for the salesman to have the intimate knowledge, which was regarded as essential, of the goods which he was selling unless he really was an engineer. Sometimes they had felt at the Institution that the fact that the electrical engineer was now more intimately connected with the industrial side than with the purely designing side, was no bar to his candidature for the Institution, so long as he had the requisite training and could show that the post he held carried with it sufficient technical responsibility. There was a great opening for commercial engineers, and he thought that such men were just what the Prince of Wales had in mind when he said that we wanted men with personality and an intimate knowledge of what they were trying to sell. He thought it was particularly fitting that the Heavy Section of the Fair should be held in Birmingham—the world's recognised seat of engineering. The Birmingham Chamber of Commerce and the Corporation of Birmingham were heartily to be congratulated on the success of their labours. He thought that everyone would agree that at the present moment the most important thing, which they had to put in front of everything else, was "Buy British." It seemed that the state of employment was the best criterion as to whether or not we were importing too much in the way of manufactured goods. With unemployed to the extent of one and a third millions, it seemed that the ordinary stock arguments for or against protection or free trade entirely fell to the ground. The conditions were entirely different from the conditions which the old economists had in mind, and he did not think that anyone would dispute the fact that with the existing unemployment, it was "up to" everyone to buy all they could that was made in Great Britain. The question which should be asked was not only "How much does it cost?" but, above all, "Where was it made?"

Visit of the E.A.W.

Members of the Electrical Association for Women were entertained to tea in the afternoon. Mr. R. A. Chattock (city electrical engineer, Birmingham) presided. He said that what they wanted to impress upon everybody was the fact that everything they required could be made in England by ourselves, for better than anybody else could make it.

Lady Brooks pleaded for more art and more beauty in the design of electrical accessories.

Some of the Exhibits.

A Further Instalment of Illustrated Notes.

Edison Swan Electric Co., Ltd.

This was a varied display of the company's products. It included the usual range of standard "Royal Ediswan" lamps, as well as "Pointolite" and "Kingolite" lamps. Among the electric lighting accessories shown was a selection of fuseboards and small switchgear, both ironclad and open type. Another section of the stand was devoted to domestic appliances and heating apparatus, such as vacuum cleaners, toasters, irons, kettles and fans, and there was a range of modern electric fires, including the "Vera" model and the 2- and 3-kW "Raymond" types. Representative samples of cables and wires manufactured at the Lydbrook Works, Glos., were on view,

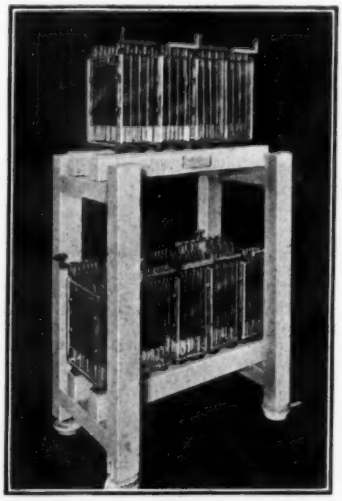


Fig. 33.—An "Ediswan" House-lighting Battery.

i.e., standard v.i.r. and c.t.s. cables, bitumen cables of all sizes, shot-firing cables and "Virite"—a special cable of compound insulation designed to resist the effects of very onerous conditions of service. The accumulator exhibit comprised a number of radio types ("Loten" and non-spillable), stationary type batteries, and motor car dry-charge starter batteries; in addition there were examples of the company's dry cells of various kinds. Several electricity meters were shown. Some Ediswan decorative fixtures were displayed in use for lighting the stand, and the latest designs of shades and standards appeared. The radio section embraced the well-known "Ediswan R.C. Threesome," mains h.t. units and receiving and transmitting valves. Our illustration (fig. 33) shows a house lighting battery which is one of the exhibits.

W. H. Dorman & Co., Ltd.

This company's principal exhibits were "Flexstel" ball and socket and rotary joints, grey iron and aluminium sand castings, aluminium alloy, lead, tin and zinc base high-pressure machine die-castings, and pressure die-casting machines. Among the grey iron castings there was a selection of sole plates and clamps for electric irons of various sizes as well as sample castings for electric boiling plates and similar accessories.

Wm. Sanders & Co.

On this stand there were shown two sections of unit boards which instead of being mounted on angle-iron frames were solidly made with cast-iron busbar chambers and solid cast-iron legs to support them. Mounted on the sections were various switches, notably the new pattern of 400-A t.p. switch-fuse. All types of the company's "Superior" switches can be mounted on this type of board. The busbar chambers are made in various lengths to suit the switches which are mounted on them, and they have no sharp corners. The company also showed a number of knife switches, notably a 1,000-A switch with two blades mounted close together on one handle, providing a large contact surface and large carrying capacity. The fuseboards shown included 30-A teak boards which are made with up to 12 ways or more if required; and 15-A boards for domestic use, produced as switch-fuseboards or d.p. fuseboards. There was also a flush type teak fuseboard which is very useful for institutions where appearance is of prime importance. This consists of a cast-iron case with wooden front which is let into the brickwork or concrete, fitted with "Ideal" fuse elements on tilting battens for easy wiring.

Other exhibits were cooker control boards with main switch and separate small plug; samples of mining type "Superior" switch and switch-fuse gear, which hold the certificate of the Sheffield University; "Superior" switch-fuses, and "Presto" switches and switch-fuses; samples of all sizes of cut-outs and ironclad fuseboards, &c.

Fescol, Ltd.

The process by which this company deposits metals, particularly nickel and chromium, has already been described in the Electrical Review. The company's exhibit consisted of many examples of its work, mainly in the direction of building up worn parts. It is claimed that the deposit is unstrippable, cohesive and adhesive, forming an integral part of the base metal.

Wardle Engineering Co., Ltd.

This company's exhibit comprised a number of reflectors, lanterns and lighting fittings for industrial use, and street lighting equipment. The "One Piece" reflectors shown incorporate a patent easy-wiring cap and vibration-proof porcelain lampholder. Bruce "One Piece" copper lanterns, incorporating a dust-tight "Holophane" dome refractor with internal prisms have been produced for main street lighting.

Wardle glass units for offices, classrooms, and similar situations were displayed in adjoining stands. The glass is three ply, of pleasing appearance with minimum absorption coefficient. "Prismat" bulkhead fittings were also on view. These have been designed to secure definite control of the light rays in any required direction, and are intended to replace the bulkhead fitting of conventional design in tunnels, inspection pits, corridors, subways and similar situations.

Jackson Electric Stove Co., Ltd.

As usual, this company exhibited several examples of its cookers, fires, water-heating apparatus, &c. Among the cookers were the new "Jackson Junior" and the "Model No. 46," which we have recently described in our pages. Another interesting exhibit was the "No. 75" "Colonial" cooker, designed especially to meet the requirements of Empire markets. The cooker (fig. 34) has an oven with a cooking space measuring 13¾ in. high, 13¾ in. wide, and 15¼ in. deep, loaded to 1,650 W, and fitted with a drop-down door. The oven is surmounted by a hob fitted with a grill-boiling plate measuring 9 in. by 7¼ in., loaded to 1,800 W, and two "No. 86" hot-

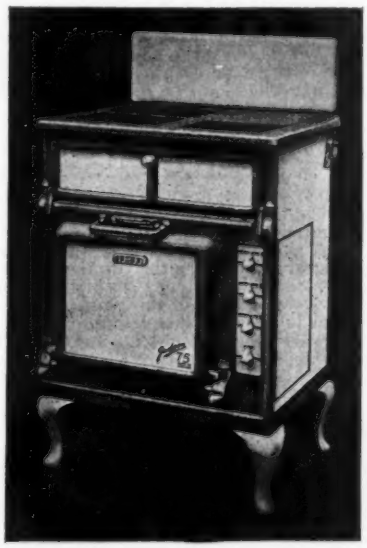


Fig. 34.—The Jackson "Colonial" Cooker.

plates measuring 8¼ in. by 6 in., and loaded to 1,500 W each. All the units are arranged for 3-heat control by switches and fuses fitted in the control space on the side of the cooker. The space between the hob and the top of the oven is fitted with a drop-down door. Both the oven and hot cupboard are fitted with white panels mottled grey inside. The switch direction plate fitted is finished in white vitreous enamel with black lettering. The total height of the cooker is 36 in. It can be fitted with either a short splashplate or a standard plate-rack and splash plate. A thermometer is fitted to the cooker body (not to the oven door) and the oven is heavily lagged.

Fox & Offord, Ltd.

This company exhibited at the Fair for the first time, and its display comprised direct-current meters, new patent prepayment meters, a patent electro-mechanical production and stock balance indicator, moulds for the production of "Bakelite" and other synthetic products, grinding spindles, jigs and fine tools, and pump conversion sets.

H. E. Ashdown, Ltd.

Messrs. Ashdown again had a display of various types of mouldings in "Bakelite" and synthetic resins. The company not only makes the mouldings, but it also produces and machines all metal parts, turning out a complete and finished article to specification.

Their latest development is a standard set of eight mouldings with which a wireman can assemble either a cord grip, screwed or batten type holder (with shade ring or skirt), or ceiling rose as required, thus eliminating delays when requiring an odd fitting. Another new accessory is an adjustable two-pin to b.c. adaptor, which is adjusted by a revolving and insulated ring on the body of the plug, thus guarding the user against shock. The cam action of the pins in relation to the thread motion is such that while the adjusting cap is easily revolved by hand, it will not do so whilst being transferred from one socket to another, thus altering the setting of pins. There is also a large and comprehensive range of general commercial mouldings.

Brantford Washing Machine Co., Ltd.

The British representatives of this Canadian company (the Sloan Electrical Co., Ltd.), had on view examples of the "Locomotive" washing machine which embodies a number of new features. The main part of this is a copper tank with a heavily-plated interior. This is equipped with small wheels running upon rails. By means of a crank on the shaft of the driving motor the tank is moved to and fro, and by reason of this and its shape the water is given a "figure of 8" motion and is swirled through the clothes. This obviates the use of a dolly or other moving device in the tank itself. There is a wringer which can be detached and packed neatly by the tank in the casing, the tank automatically locking into an end position when not in operation, and the whole of the equipment is mounted on castors for easy movement and covered in to form a table. Beneath the tank is fitted a 600-W heating element which can be switched on a reasonable time before washing is commenced to boil the water; as the tank when closed is airtight there is little heat loss. The wringer is provided with an ingenious release device which opens up the rollers immediately anything above a certain thickness gets between them. It is claimed that there is nothing in the whole equipment which can rust. The washer is well illustrated in the accompanying picture of the stand on which it was displayed (fig. 35). The model on the left of the illustration is fitted with a glass front for demonstration purposes. On the right the machine is shown disassembled.

Fig. 35.—The "Locomotive" Washing Machine.

J. H. Connor & Son, Ltd.

This was another washing machine company which exhibited in the Canadian section. The "Connor" electric washer is of the dolly type. Special attention is drawn to the container, the interior of which is of nickel-plated copper; there is an outer casing of sheet steel and between the two there is heat-insulating packing. The aluminium dolly has a reversing motion which is operated by a knob in the centre. The wringer is somewhat similar in design to that described above, the rollers springing well apart upon encountering any obstruction. The machines are equipped with British Thomson-Houston motors.

Moffats, Ltd.

This year the company was with its compatriots in the Canadian section, and it showed four examples of its "Gold Medal" cookers. The principal feature emphasised by the makers of these cookers is the porcelain enamel finish both within and without. One of the models on view was finished in a beautiful pale green; in the others the predominant colour was a kind of dove-grey. They would certainly brighten any kitchen considerably. Top and bottom elements are employed and from two to four boiling rings are provided. Each cooker has a thermometer fitted in the door, some of them having a compensated dial type.

Monarch Battery Manufacturing Co., Ltd.

This company also appeared in the Canadian section and showed a number of samples of its secondary batteries, most of which were fitted in ebonite cases.

Mudie's Electrical Co., Ltd.

Among the exhibits of this company were air-break free-handle circuit-breakers. This type cannot be held in against an overload—and the handle is used for both closing and opening the breaker. The moving contact is a laminated brush mounted on a rocker free to move on a spindle, which makes the brush self-aligning and equalises the pressure on both contacts. All parts are liberally rated to ensure cool running under rated load; and a noteworthy point is the long "wipe" which the brush makes on the contact blocks. The final break is between substantial carbon blocks, and a magnetic blow-out may be fitted. The breakers are supplied s.p., d.p., t.p., or 4-pole, and can also be supplied enclosed in sheet steel cases. The company also showed an oil-immersed wall-mounting ironclad circuit-breaker; an 11,000-V 3-phase oil switch for cubicle mounting fitted with self-contained anti-surging resistances, and hand-operated handle gear with t.p. overload and no-volt trip coils in a combined trip box; strip-type panel-mounting knife switches; h.p. and e.h.p. pole-operated isolating switches; current transformers of various types; a 3-phase ammeter switch; automatic electromagnetic battery switches; and cast brass switchboard labels.

Crosthwaite Engineering & Furnace Co., Ltd.

On this stand there was shown the Crosthwaite improved type of patent mechanical stoker and self-cleaning furnace which is claimed to give complete combustion of fuel, elimination of smoke without the need for admitting excess air, and easy and simple working, and to retain the advantages of hand firing without the disadvantages of mechanical stoking. There was also a Crosthwaite patent self-cleaning furnace especially designed for the economical burning of slurry and other waste fuels.

John Harper & Co., Ltd.

This exhibit comprised a full range of sand-blasted castings for all branches of the engineering and hardware industries, with examples of electrical instruments, meters, radiators, switchgear, motors, resistances, &c., adapted for machining by modern jig methods.

Rapid Magnetting Machine Co., Ltd.

New types of special electromagnetic equipment were shown by this company, and practical demonstrations of lifting magnets and seperating machines were given. In connection with pulverised fuel there was a new machine with jig shaker feed, which can be automatically regulated, embodying a recently-developed rotary separator which has special stationary magnets, about which the drum revolves. The drums are 24 in. in diameter and are listed in a range in multiples of approximately 6 in. in width up to 4 ft. A special motor blower for blowing dust from windings, &c., was another exhibit. This is a self-contained machine, mounted on a portable trolley complete with flexible hose and suitable starting switchgear. There was also a 20-in. diameter totally-enclosed magnetic clutch, for line shaft drive for power transmission and machine tool drives. Other exhibits were a new type of rotary separator used in connection with tea blending, and similar granular sifting machinery, for the extraction of iron, and a "chute" type. The high intensity electromagnetic chute is interconnected and interlocked with switchgear in such a way that in the event of the current failing, not only does a collapsible bridge divert the iron adhering to the poles, but the feed is automatically shut off, the switch is cut out, and an alarm bell rings. Another type of equipment recently developed is a special light electromagnet for use in conjunction with pickling and acid vats.

Dexine, Ltd.

Among a large collection of "Dexine" (rubber) and "Dexonite" (hard rubber) products for all purposes were a number of electrical components and accessories.

Credenda Conduits Co., Ltd.

On this stand, which was a particularly large one (45 ft. by 20 ft.) was an excellent display of "Creda" electric heating and cooking apparatus. Examples of the latest types of "Creda" cookers in "standard" and "de luxe" finishes, occupied one end of the stand, the "deluxe" finish comprising all vitreous enamel, white and granite grey. For fine finish and workmanlike design and construction these cookers are in the front rank. At the other end of the stand were examples from the range of over 30 designs of electric fires made by the

Fig. 36.—A "Creda" Water Heater.

company, including imitation coal fires. Many other appliances were exhibited on the stand, including electric kettles, irons, toasters, grills, wash boilers, &c. The finely-finished automatic water heaters which were shown at the last Fair for the first time again appeared; the company says that since then a very big business has developed in them. They provide an absolutely automatic supply of boiling hot water for all domestic purposes, *i.e.*, baths, washing, &c., cheaply and economically. One of them is illustrated in fig. 36. Samples were also exhibited of "Credenda" conduits and conduit fittings, and the stand was illuminated by "Credalux" reflectors. A new line of "Credalux" streettlighting fittings was also exhibited.

F. Gilman (B.S.T.), Ltd.

This company showed, in operation, the various mechanical devices which it manufactures for carrying out every type of tube and surface scaling work. A flexible-shaft general-utility tool was shown. This can be fitted with drilling heads, emery wheels the "Skatoskalo" boiler-scaling chipper, and "Skatoskalo" rotary type heads for surface scaling, &c. The machine shown embodied a ½-h.p. electric motor, but various other arrangements are available.

Alfred Herbert, Ltd.

In addition to a large display of machine tools of various kinds, this company exhibited a typical "Atritor" coal-drying pulverising and firing machine. The use of this machine, which treats and fires the coal as required, obviates the storage of pulverised coal which presents difficulties and dangers.

Vitalite Co., Ltd.

Examples of "Vanalite" material and products were shown by this company. This composition although used for many kinds of mouldings, is particularly suitable for electrical work. Official tests have shown a break-down figure of about 20,000 V r.m.s. per millimetre thickness. It is non-inflammable and non-hygroscopic, and can be made in a great variety of colours. The "Vangard" pear switch which was also shown has several novel features. The case is made of "Vanalite" in a number of colours; the interior is of the best British vitreous china. Instead of plungers there are patented multifold spring contacts which produce high surface conductivity, smooth movement and definite action. The ends of the leads are kept entirely separate, and the cords are automatically gripped between the interior and the case. Every switch has a one-or two-way action, and it is claimed that the safe current carrying capacity is 3 A on a 250-V circuit. Miniature switches and lampholders embodying similar features were also shown.

Coventry Chain Co., Ltd.

Upon this stand were shown roller and inverted-tooth type chains for every class of industrial drive, chain couplings, speed-reduction and increase gear boxes, stud chains, pipe chains, balance chains and chains for elevating, conveying and a variety of special purposes. The central exhibit was a working model of a patent chain elevator.

Filtrators, Ltd.

This exhibit consisted of a complete plant for dealing with boiler-feed water, comprising a "Filtrator" and the "Filtrator" continuous blow-down and heat-recovery plant. The plant was shown with all connections made to a standard boiler. The company's system is non-chemical. By a physical process all scale-forming particles in boiler feed water are coated by colloidal starches extracted from linseed. They are prevented from adhering to each other and to the heating surfaces, and thus prevent the formation of hard scale. The sludge which is formed is removed by the continuous blow down. The heat which is lost by intermittent blowing down is returned to the feed water tank, a considerable portion of it as steam, the remainder in the form of clean water.

Langham Gears.

Motors with totally-enclosed reduction gearing were again shown by this firm, including triple-geared models capable of reducing the speed to 15 r.p.m. A number of applications of these motors were also shown.

Bulpitt & Sons, Ltd.

In addition to a very extensive display of aluminium ware, on stands in the hardware and electrical sections, this company exhibited a number of domestic electrical appliances, including kettles, percolators, urns, bowl fires, &c. A special exhibit was a hospital steriliser fitted with patent renewable immersion elements and a safety device.

B.K.B. Electric Motors, Ltd.

This company had a comprehensive exhibit of small electric motors, ranging from 1/100 h.p. to 5 h.p., of which 400 different ratings are available in fractional horse-power sizes alone, both for a.c. and for d.c. Special finishes are obtainable for high-grade instrument work, and there are designs applicable to every domestic or industrial purpose. The company also manufactures motor generators, "universal" motors, convertors, dynamos, static transformers, and high-tension generators for wireless and kindred purposes. A new line of universal motors with foot speed control for sewing machines and light dental work, &c., was exhibited.

Streetly Manufacturing Co., Ltd.

A variety of articles used in the motor, electrical and other industries, moulded from "Bakelite" and "Beetle" powders appeared on this stand. Hitherto, mouldings from synthetic resinous compounds have been largely limited to the darker shades, but the introduction of "Beetle" powders has made possible their manufacture in all colours—plain or mottled.

Bromford Tube Co., Ltd.

This exhibit comprised boiler tubes, steam mains, superheater tubes and elements, cable and telephone ducts, coils and manipulated tubing, &c. The company also exhibited seamless steel lighting standards and transmission poles, and has recently introduced new lighting standards with fluted columns. They are very attractive in appearance and are claimed to be superior to cast-iron in every way.

British Sangamo Co., Ltd.

A number of examples of high-grade instruments were on view on this company's stand. Among them were watt-hour and ampere-hour meters for a.c. and d.c., switchboard and house-service patterns.

Ruston & Hornsby, Ltd.

Included in this exhibit was a 20-b.h.p. cold-starting horizontal oil engine, designed to run on a wide range of cheap fuel oils. These engines are made in a range of sizes from 16 to 260 b.h.p. There was also a cold-starting vertical oil engine, 3-cylinder, rated at 100 b.h.p. This type is stated to be particularly well suited for generating electricity. A patented feature of the Ruston engine is the fuel distributor gear which ensures an equal distribution of fuel to all cylinders. The engines available cover sizes up to 1,000 b.h.p. Pumps and pumping plant and a "Thermax" vertical boiler were also shown. An exhibit which attracted a great deal of attention was a back-acting trenching machine weighing about 14 tons shown working.

National Gas Engine Co., Ltd.

The engine exhibit of this company included an "MHE" type engine and chain-driven dynamo rated at 7 kW maximum, 6¼ kW constant load. The engine is of the horizontal tube starting type, using cheap heavy oil as fuel. An ignition tube is incorporated in connection with the vaporiser. This tube is heated by means of a lamp, the time required not exceeding three minutes. The dynamo is of the Electric Construction Co.'s manufacture. There was also an "F" type gas engine and direct-coupled dynamo. The engine was of the horizontal totally-enclosed type, and the output of the set was 1 kW.

Pneulec, Ltd.

The "Pneulec Royer" sand-mixing machine for foundry use was shown by this company. This machine combs the sand and makes it easy to work. It is mounted on wheels and operated by an electric motor which, of course, is totally enclosed.

Wolseley Sheep Shearing Machine Co., Ltd.

The sheep-shearing machines shown by this company included electrically-driven models. In addition to these there were shown petrol engines and electric generating sets. The latter included examples of the sets which the company makes in 1, 2 and 3-kW sizes, gear-belt or chain driven. The gear-driven and chain-driven models are specially constructed for economising floor space.

Micanite & Insulators Co., Ltd.

A comprehensive display of all classes of insulating materials including mica, micanite, paxolin (" Bakelite "), varnish-paper, empire cloths, tapes, papers, leatheroid, &c., appeared on this stand. A feature of the exhibit was a complete range of indoor and outdoor condenser-type terminals and bushings for transformers and switchgear including a 132-kV terminal designed to meet the requirements of the Central Electricity Board.

Henry Hope & Sons, Ltd.

An interesting exhibit on this stand was a typical factory " north-light " roof constructed with the company's patent glazing, and having a continuous opening light in the upper portion, extending the whole length, which could be opened and closed electrically by pressing a button.

Earle, Bourne & Co., Ltd.

This company had on view a comprehensive range of manufactures including cold-rolled brass, of various alloys, and copper; solid drawn brass and copper tubes for locomotives, condensers, &c.; brazed brass and copper tubes; angles, channels, and sections, &c.

Heyes & Co., Ltd.

This company exhibited an extensive range of " Wigan " flameproof and industrial type specialities, including mine signalling equipment, lamp fittings, prismatic bulkhead fittings, telephones, flameproof and watertight air-break switchgear, bells, keys, pushes, armour glands, &c. A modern type of luminous indicator for mine shaft signalling was shown in operation, together with suitable bells and keys. The switchgear included single units of the watertight and flameproof type, and pedestal type switch panels with various sizes of outgoing feeder switches.

Cellon (Richmond), Ltd.

The exhibits upon this stand comprised a range of various articles finished throughout with " Cerric " cellulose lacquers, including a number of electrical fittings, insulating slabs, &c.

Drayton Regulator & Instrument Co., Ltd.

Many types of temperature and pressure regulators and steam fittings were exhibited by this company.

May & Padmore, Ltd.

Among a large general display of its products, this company included a few examples of its " Maymore " electric fires, cooking apparatus, soldering irons, &c.

Braithwaite & Co. (Engineers), Ltd.

This company erected a steel transmission line tower in the grounds adjoining the Fair building. This was equipped with suspension and strain type insulators supporting a truck to demonstrate their strength. The insulators were produced by Steatite and Porcelain Products, Ltd.

R. M. Catterson-Smith.

Automatic-feed tube furnaces (electrically operated) for continuous processes were exemplified by this exhibit. There were also examples of other electric furnaces for ceramic work, &c.

E.A. Manufacturing Co., Ltd.

Among the exhibits on this stand were examples of the company's lampholders and ceiling plates fitted with an easily-manipulated cord grip.

Sperryn & Co.

This exhibit comprised samples of " Sperrynwood " switches, fuses and other electrical equipment.

Exhibits at the White City.

Doulton & Co., Ltd.

Included in a most attractive display of pottery, china, and earthenware, at this firm's stand was a series of electric table

Fig. 37.—A Doulton Table Lamp.

lamps consisting of a combination of wooden bases, artistic china, figures and groups, and silk shades. One of these is illustrated in fig. 37.

British Celanese, Ltd.

" Celastoid," which is used for insulation as well as other purposes, was shown at this stand in a full range both of transparent and opaque colours. The material is non-inflammable, and among its uses is that of lamp shade manufacture. Specimens of " Celastine " moulding powders for producing insulating mouldings of all descriptions were also shown, together with specimens of moulded rods and sheets.

A. W. Beuttell, Ltd.

This firm had an artistically-arranged stand showing various applications of the " K-Ray " device for the lighting of shop facias, name boards, pictures, posters, &c. The illumination is effected by a single row of concealed lamps, either at the top or bottom, used in conjunction with a slightly concave glass window. The light from the lamp is thrown on the inner surface of the glass, which gathers up the light and transmits it evenly over the whole surface at once. The glass is slightly inclined, so as to meet the display at the bottom edge, and leave a narrow space at the top, through which the light is thrown on to the window at such an angle of incidence that it acts as a perfect, though invisible, reflector. The firm also displayed various examples of " Linolite " strip-lighting reflectors and " Little Giant " reflectors, in which standard lamps are used.

Dowsing Radiant Heat Co., Ltd.

A varied display was made by this concern. There were a range of " Solarium " sun baths in a variety of patterns, portable and pedestal massaging vibrators, ultra-violet ray lamps in standard and portable types, combined galvanic and Faraday current apparatus and other electromedical instruments. Another section of the stand was devoted to examples of radiant bowl fires, " Hotpoint " cookers, hot-plates, laundry and domestic irons, and a stand for electrically-heating irons. Electric kettles, saucepans, copper urns, sealing wax heaters, soldering irons, glue pots, and laundry machinery were also included in the display.

The Radio Section.

Although the Radio Section was not fully representative of the industry, it was on a larger scale than last year, the space occupied having increased from 6,400 sq. ft. to 8,500 sq. ft. Astom & Mander (1917), Ltd., who specialise in the manufacture of wooden cabinets for receiving sets, showed designs suitable for most of the instruments home-assembled from standard parts. The Brownie Wireless Co. (G.B.), Ltd., exhibited examples of its crystal and one- and three-valve receivers, together with a variety of accessories. The company has also a special department for the manufacture of insulated mouldings for radio purposes, many examples of which were displayed.

Devices designed to supply the necessary h.t. and l.t. current for radio-receiving sets direct from electric light circuits were displayed by E. K. Cole, Ltd. Trickle chargers were also shown, while the firm's latest introduction is the " Ekco Electric Straight Three " radio receiving set entirely operated by connection to a wall plug.

J. Dyson, Ltd., in addition to portable radio receivers and components, displayed a range of d.c. and a.c. eliminators. These are made in various sizes, including one with a range of from 40 to 200 V, for use with sets up to eight valves.

J. J. Eastick & Sons displayed a complete range of ter-

minals and other accessories for radio use, together with examples of multiple connectors, special lightning protection switches, &c. At this stand a novel radio loud speaker, known as the "Conchophone," was also shown by A. J. Wright, Ltd., in which a natural shell is used in place of the usual cone or horn. A novel radio cabinet was shown by Hamiltons (Arundel), Ltd., the feature being that the sides are all hinged, so that they can be quickly dropped down to give ready access to the component parts of radio receiving sets. Another novelty was an indoor aerial, arranged to be used below, and in conjunction with, an ordinary telephone receiver and transmitter.

The principal exhibit of the Neophone Engineering Co. was a new seamless-cone diaphragm for loud speakers, made of vulcanite, for which maximum clarity and volume are claimed. The diaphragm is being supplied either separately or in complete cabinet loud speaker form. Among other concerns showing radio sets and components were C. Creswick Atkinson, Burgoyne Wireless, Ltd., Cliftophone & Records, Edison-Bell, Ltd., the Formo Co., Garnett, Whiteley and Co., Ltd., Graham Farish, Ltd., the Halcyon Wireless Co., Ltd., Henry W. King & Son, Langham Radio, Eric J. Lever (Trix), Ltd., Lissen, Ltd., the Loewe Radio Co., Ltd., "M.P.A." Wireless, Ltd., the Mic Wireless Co., Ormond Engineering Co., Ltd., Read Radio, Ltd., Rees-Mace Manufacturing Co., Ltd., Rialton Radio, the Ricarda Electric Co., the Savoy Radio Co., Selectors, Ltd., Steval, Ltd., Stratton & Co., Ltd., Triotone, Ltd., Truphonic Radio, Ltd., Wandle Radio Co., Watmel Wireless Co., Ltd., Whittingham, Smith & Co., and Wright & Weaire, Ltd.

A new feature of the display was the appearance for the first time of a number of combined radio receivers and electric gramophones, among the exhibitors of these being the Ambassador Talking Machine Co., Ltd., the Apollo Gramophone Co., Ltd., the British Homophone Co., Ltd., Celebritone, Ltd., Celebrity Gramophones, Ltd., Cook's Wireless Co., Ltd., Edison-Bell, Ltd., Gradiophone (Cabinets), Ltd., Langham Radio, Lissen, Ltd., Ormond Engineering Co., Ltd., Phantestra (Renns), Gramophone & Wireless, Ltd., Radio-Tri-Phone, Ltd., Rialton Radio, the Wandle Radio Co., and the Watmel Wireless Co., Ltd.

M.L. Magneto Syndicate, Ltd.

A prominent position was given on this stand to "M.L." rotary transformers for use in connection with radio transmission and reception, these being made in sizes, ranging from 12 V for accumulators, up to 200 V for mains supply, with outputs varying from 15 mA at 120 V up to 200 mA at 500 V, including a type for 12 V input, giving 50 mA at 1,000 V. A range of anode convertors was also shown, these being adapted to be operated either from 6- or 12-V accumulators, or from 100- or 200-V mains. Combined motor-generator sets were displayed ranging in output from 15 to 170 W. A small but interesting machine was a hand-driven generator

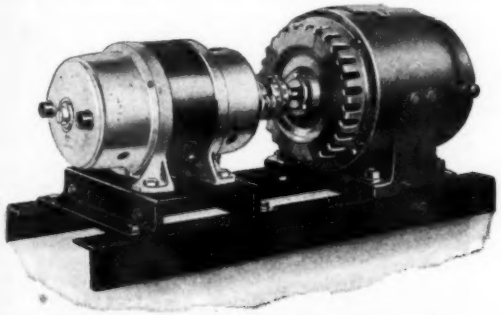


Fig. 38.—An "M.L." Motor-generator.

of a type largely used in connection with aeroplanes; it can supply either h.t. or l.t. current to a radio transmitter, an automatic signalling device being also provided to enable messages to be transmitted by an unskilled operator. The machine, which consists essentially of a permanent-magnet field generator, the armature of which is provided with two windings insulated from one another, and two commutators, has an output of 40 W. Gearing of 28 : 1 ratio is fitted between the armature shaft and the driving handle. The M.L. Co. also displayed moulded radio components. One of the company's motor-generator sets is illustrated in fig. 38.

Dubilier Condenser Co. (1925), Ltd., and Isenthal and Co., Ltd.

In addition to various specialities for radio use the Dubilier Co. showed examples of static condenser for power factor improvement, for power transmission line protection, and for laboratory use. Condenser blocks for use in conjunction with radio battery eliminators were also shown. Part of the stand was occupied by Isenthal & Co., Ltd., who had on view examples of mercury switches and relays, automatic voltage regulators, h.p. air-break switches, electromagnetic relays, remote control switches and tubular sliding rheostats.

Westinghouse Brake & Saxby Signal Co., Ltd.

Examples of the complete range of Westinghouse metal rectifiers for all purposes were shown on this company's stand, including instruments not only for radio use, but also for alternator excitation, battery-charging, lift-gate control, electro-plating and electro-medical apparatus. Special attention was drawn to a 1,000-V rectifier for radio transmission purposes and to a small rectifier adapted to obtain a direct supply from a.c. mains for feeding the pot-magnet windings

Fig. 39.—A Westinghouse Battery Charger.

of moving coil loud speakers. Other Westinghouse productions displayed included moving coil d.c. volt- and ammeters, portable a.c. testing voltmeters and a new four-circuit battery charging set specially designed for the charging of accumulators in motor garages and service stations (fig. 39). The four circuits provided are: 0.25 A, 150 V for h.t. cells; 0.5 A and 1.5 A, 150 V for low-capacity accumulators; and 5 A, 30 V for engine starter batteries. All the circuits are variable by means of tapping switches with final adjustment by sliding resistances.

Birkbys, Ltd.

The principal exhibit on this stand was the "Elo" synthetic resin product comprising mouldings, moulding powders, and insulating varnish. Among the samples of mouldings shown were armature and commutator parts, instrument covers, fuse blocks and cases, switch handles, magneto parts, meter cases, and radio components.

British Motor Sign Co.

An ingenious moving sign was shown at this stand. It consists of a small electrical projector and a film containing any message up to a maximum of 170 words. The film is driven by a fractional h.p. electric motor, and can be projected to a distance of 150 ft.

Ever Ready Co. (Great Britain), Ltd.

Dry batteries of all sizes and shapes to meet every possible requirement were again displayed by this company, special attention being drawn to those suitable for radio purposes. Samples of l.t. accumulators, portable electric lamps, and motor vehicle lighting accessories were also shown. A similar exhibit was staged at Birmingham.

Ferranti, Ltd.

Audio-frequency transformers were prominently displayed by this company, together with loud speakers, trickle chargers, h.t. supply units, and measuring instruments. The exhibit also included a high-power amplifier employed to convey the radio programmes from the London broadcasting station to loud speakers on each of the stands of the principal exhibitors of radio receiving sets.

Franco-British Electrical Co., Ltd.

This concern specialises in electrically-illuminated signs for all purposes. Special features of the exhibit were a new form of letter for shop signs, illuminated by reflected light from an electric lamp fitted in its centre, and a seven-switch flashing sign, the controller of which is driven by a ½-h.p. motor.

Sign Construction Co., Ltd.

At this stand was shown in operation one of the electric newspaper signs described and illustrated in our issue of April 8th, 1927. The installation comprises a long frame enclosing a very large number of compactly-arranged electric lamps, connected by leads to a special electrically-operated contact maker over which a perforated strip operates.

Freezone, Ltd.

Several examples of electrically-operated refrigerators for household, hotel and club use were shown by this company. The freezing unit, which is separate from the cabinet, is driven by a small motor, a thermostat being incorporated to control the temperature.

Indurite Agency.

This concern specialises on the production and supply of a moulding powder known as "Indurite," and insulating mouldings made therefrom for a variety of purposes, including electrical and radio work, were shown.

Igranic Electric Co., Ltd.

A new device shown by this company was a screened-grid short-wave valve receiver. Another interesting exhibit was the "Phonovox" electrical reproducing equipment for use in connection with gramophones, this embodying an electrically-operated turntable, a special amplifier unit and a power supply unit for working off a.c. lighting circuits. The company also demonstrated its transverse current microphones and control units for use in broadcasting stations, public halls, &c.

K.F.M. Engineering Co., Ltd.

This firm specialises in the production of tubular lamp holders and reflectors for the lighting of shop windows, showcases, pictures, &c. Tubular lamps of 20- and 30-W capacity, 8¾ in. or 11 3/16 in. in length, are used, these being held between end blocks, which obviate the use of flexible conductors between the ends of the lamp. Three types—wide, narrow, and case-light—are made, these being available in lengths from 11 in. up to 12 ft.

Automatic Sun-Blind Co., Ltd.

One of the novelties of the Fair was this company's electrically-operated shop blind, which was described in our issue of December 21st, 1928 (p. 1091). It comprises an enclosed ¼-h.p. motor mounted within the blind roller. The latter is driven through a reduction gear running in oil and a coil spring, a special coupling being provided between the reduction gear and the driving plate.

Axuel Time Switches, Ltd.

In addition to the "Axuel" radio programme selector, by means of which radio receiving sets can be automatically switched on and off at any predetermined times, this firm displayed a new "four-in-one" radio valve made by the Quadruple Valve Co., Ltd., Northampton, which combines in one valve the functions of h.f. amplifier, detector, and first and second l.f. amplifiers.

Fraser & Glass.

Mouldings in "Omnite" were among the leading exhibits of this firm, many examples in various colours for electrical and radio purposes being displayed. Mouldings from Bakelite powders were also shown.

Belling & Lee, Ltd.

Indicating terminals for electrical and radio use are the main product of this firm, the range including terminals with markings in a number of European languages, as well as with American markings. A new line shown was an all-insulated plug and socket combination.

Beetle Products Co., Ltd., and British Cyanide Co., Ltd.

Another interesting section of the Fair comprised numerous exhibits of powders for producing non-inflammable high dielectric mouldings and of components made from such preparations. Among the exhibitors in this section was a joint one by the two concerns named above, who showed "Beetle" moulding powders in a variety of colours and "Beetle" synthetic resins, together with examples of moulded parts, such as switch covers, brackets, and electric table lamps.

H. Clarke & Co. (Manchester), Ltd.

This firm specialises in mains units for use with radio receiving sets. A new short-wave coil was seen among the range of coils displayed, while resistance coupling units, fixed condensers, and "Pirtoid" tubing were all on view. Electrical insulating materials are an important branch of the firm's activities, among those shown being vulcanised fibre, presspahn, and mica. The firm has introduced a new accumulator charging set with Westinghouse rectifier, and arranged for an output of from 1 to 5 A, the control being effected by a five-point switch.

S. G. Brown, Ltd.

In addition to a range of its latest moving-coil radio loud speakers, this company displayed examples of radio transformers, gyro compasses, and electro-megaphones.

Thomas De La Rue & Co., Ltd.

This firm showed examples of sixty grades of "Telenduron" insulated mouldings ranging from small radio components to large insulating links capable of withstanding considerable strain. Specimens of accumulator boxes were also shown, together with specimens of mouldings with metal inserts.

London Metal Warehouses, Ltd.

Plain and enamelled copper, phosphor bronze and aluminium wires for use for aerials and other radio purposes were on view. A large range of "Lunmet" insulated terminals was also displayed.

Bakelite, Ltd.

This company displayed a wide range of mouldings made from "Bakelite." Special attention was also drawn to a new flaked fabric material recently introduced by means of which, owing to the introduction of small flakes of fabric, mouldings with a higher shock resistance can be produced. Other exhibits included "Bakelite" cement, lacquer, and varnish—the latter being used for the insulation of coils, windings, &c.—and "Damarda" lacquer for colouring electric lamp bulbs.

Spauldings, Ltd.

Mouldings made of vulcanite, fibre and "Bakelite" are among the specialities of this concern, which exhibited a wide range of moulded parts for the electrical and radio trades. The mouldings can be supplied in various colours.

Mullard Wireless Service Co., Ltd.

Examples of the wide range of "Mullard" radio valves were to be seen at this stand, including the latest screened-grid and "Pentone" valves. Other exhibits were loud speakers, battery eliminators, wire-wound resistances, resistance-capacity coupling units and combined grid leak and condenser units on moulded bases.

Solaflex Amalgamated, Ltd.

At this stand were to be seen several patterns of Berry's "Magicoal" and "Newberry" electric fires and "Kangaroo" heaters. The greater part of the stand was, however, devoted to a range of day and night advertising signs, including the "Berrylite" and the "Luna."

Solidite and Synthetic Mouldings, Ltd.

This concern displayed many examples of "Bakelite" mouldings, for the electrical and radio trades, in a variety of colours, and made to very fine limits.

Telegraph Condenser Co., Ltd.

This concern displayed a variety of condensers for use in connection with radio and h.p. cable work. Particular attention was drawn to a mica transmitting condenser with a capacity of 0.003 mfd., the mica being immersed in oil in a sheet-metal case, it being intended to carry 30 A at 100 kilocycles. Smoothing condensers designed for a maximum working pressure of 2,500 V in various capacities were also displayed.

Advertising and Illuminated Signs.

Electrically-illuminated advertising signs were shown by quite a number of concerns, to which, however, only a brief reference can be made. Marathon, Ltd., exhibited an ingenious running sign which can display any message up to 27 ft. in length; detachable letters are used, and the outfit is operated by a 1/40-h.p. motor. The Power Engineering Co. introduced a new type of changing-colour sign, in which the different colours are gradually blended into each other by means of a special belt-driven commutator. Other exhibitors in this section included the Anglo-Scandia Co., Ltd., the Allan Manufacturing Co., the "Attracta" Electrical Co., Thos. Digby Illuminating Engineering Co., Ltd., the Glow-Activa Sign Co. (1928), Ltd., and United Signs, Ltd.

Electric Lighting Fittings.

Among the exhibitors of electric floor and table standards were J. Pope, who showed them finished in attractive colours of "Nacrolacque," shades of the same material to match being provided. Those displayed by Goodworks, Ltd., were notable in that they were made of ivory and choice colours of synthetic resins. The table lamps shown by Henry W. King & Son were of interest; the glass bowls were painted on the inside, to which also real butterfly wings were attached. The Shoreditch Wood Turning Co., Ltd., specialises in the production of wooden floor and table standards finished in Chinese lacquer. In the glass section electric table lamps and shades made of cut glass were shown by Stevens & Williams, Ltd., John Walsh, Ltd., and F. Wilkinson & Co. Artistic electric light fittings were displayed by the Birmingham Guild, Ltd., and the Pearson Page Co., Ltd.

One of the most striking features of the Fair was the extensive and artistic displays of electric lamp shades. These are being made in almost every possible material, ranging from glass to nacrolacque, not excluding ramie and imitation pigskin. Among the exhibitors in this section were Albion Shades, Ltd., who displayed, among others, shades made of "Velskin," a non-inflammable material made by a cellulose process to imitate real vellum. Artistic Lampshade Manufacturers showed both electric lamp standards and shades finished in fancy colours of nacrolaque. A novelty at this stand was a combined table lamp and radio loud speaker, the latter, of the cone type, being incorporated with the top of the shade.

Miscellaneous.

In addition to the exhibitors mentioned there were many lamp shades and other lighting fittings displayed, as well as electrical novelties of various kinds. One or two firms showed apparatus for the assistance of the deaf, including "Oravox" equipment, which is compact and light. The makers (Oravox, Ltd.) have designed a special equipment for use in churches.

The Ideal Home Exhibition.—I.

A Review of the Electrical Features.

THE electrical aspect of the *Daily Mail* Ideal Home Exhibition, the twenty-first of which was opened at Olympia on February 26th and will continue until March 23rd, becomes increasingiy important as time goes on. Practically every new development affecting the domestic side of the industry is represented at the Exhibition and is being practically demonstrated to the many thousands of visitors. As usual, a large number of the leading electrical manufacturers are represented, showing improved appliances for electric lighting, heating, cooking, ventilation, and so on.

A spectacular feature of the Exhibition is the large "Mazdalux" electric fountain, fig. 1, which has been erected in the main hall by the British Thomson-Houston Co., Ltd. Electrically illuminated fountains are, of course, not new, for they formed a feature of the Inventions Exhibition at South Kensington as long ago as 1885, but the present apparatus, which weighs approximately 50 tons, is of a quite different form and much more beautiful than anything previously achieved in this country. A lower basin, measuring 30 ft. across, is mounted on a steel supporting structure at a height of 14 ft. above the ground level. In the centre of the pool is a tower supporting an upper basin 16 ft. in diameter. In the latter are five banks of nozzles from which spring huge jets of water, the heights of which are controlled and varied automatically. With the rapidly-changing colour effects produced by means of a battery of 30 B.T.H. floodlight projectors, concealed beneath the water in the upper basin, the fountain provides a noteworthy spectacle. When in operation there are no fewer than seventy-two different combined water and colour effects every eight minutes. Further spectacular effects are provided by the illumination, in a variety of changing colours, of the water flowing over the weir from the upper to the lower basin; this is achieved by means of 120 "Mazda" colour-sprayed lamps concealed under the rim of the upper basin, in conjunction with flashing devices.

All the apparatus for operating the fountain, consisting of a motor-driven centrifugal pump for producing the necessary water pressure, the electric flashing devices for controlling

Fig. 1.—"Electric" Fountain in the Main Hall.

the colour and water effects, electrically-operated water valves, and switchgear for controlling the floodlights, is housed in the central tower, the whole being remotely-controlled from a push-button station situated in the supporting structure. The electrical and water connections were carried out by Messrs. Grierson, Ltd., while the tank work was provided by Messrs. Silas-Hyde.

On the B.T.-H. stand prominence is given to the company's automatic electric refrigerator, numerous examples of which are shown in operation. This apparatus, fig. 2, is notable for its simplicity of construction and quietness of operation. Plugged into any electric-light point it will, it is claimed, keep food under ideal conditions for a year at a cost of a few pence per week. There are no exposed working parts, all the mechanism being hermetically sealed in a steel casing on the top of the cabinet. Permanent lubrication is provided by a specially compounded oil. The B.T.-H. refrigerators are supplied in eight models suitable for the home, with capacities varying from 2½ to 18 cu. ft., and shelf areas from 5½ to 29½ sq. ft. The models are supplied in various finishes of porcelain and lacquer. In addition to the refrigerators, there are many other interesting exhibits on this stand, especially in electric lighting equipment, a variety of B.T.-H. fittings being employed for the dual purpose of illuminating

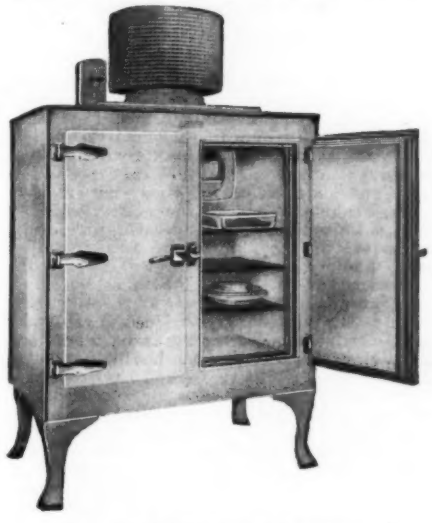


Fig. 2.—B.T.H. Refrigerator.

the stand and demonstration purposes. Finally, it may be mentioned that a corner of the exhibit is occupied by a large life-like tableau of the "Pearl Mazda" lamp showcard—"Beauty Enriched by Light."

The stand of British Vacuum Cleaner and Engineering Co., Ltd., is devoted to a display of various types of electric and non-electric vacuum cleaners. The popular electrically-operated machine is the "Goblin"; it is of the horizontal cylindrical pattern with an enclosed dust bag, two small wheels being provided at one end to enable the apparatus to be readily moved about. The motor, which drives a special high-speed suction turbine fan, is fitted with grease-filled ball bearings, and is claimed to be able to run continuously for six hours on a consumption of 1 kWh. It is supplied with 21 ft. of electric cable and 8 ft. of suction hose, together with attachments for four different cleaning operations. A range of more powerful machines is seen in the B.V.C. "Turbine" cleaners, which are made in three sizes—a domestic machine with a ⅛th-h.p. motor for home use, a ¼th-h.p. apparatus intended for department stores, kinemas, hotels, and so on, and a ½-h.p. machine for factories and other buildings where small refuse is intermingled with the dust.

Since the last Exhibition, Hoover, Ltd., has placed on the market a new heavy-duty vacuum cleaner for use in large residences, clubs, and hotels. The popular household models are also displayed, two varieties being available. Both embody the deep-breathing principle, and with them can be used the Hoover floor polisher in place of the detachable agitator.

The exhibit of Petters, Ltd., is largely confined to a range of self-contained electric generating sets for country house lighting, with or without batteries. The smallest plant is capable of providing current for the average house or bungalow, with anything from six to eight lamps. One of the most interesting exhibits is the Auto-Petter-Light, without accumulators, this being automatically controlled so that there is no need to go near the actual installation itself to start or stop the engine.

Rotapex, Ltd., is also showing electrically-operated domestic appliances. The "Apex" gyrator machine is adapted for both clothes washing and drying, being also equipped with a small hydro-extractor. A less expensive machine is the "Rotarex" washer with a power-driven wringer. Other "Rotapex" exhibits include both single- and double-roll ironing machines, refrigerating cabinets, two types of "Apex" vacuum cleaners, one known as the "Rotarex," and the "Econo" horizontal three-stage cleaner and blower.

Transmission-line Poles.

Notes on Timber Preservation by the Creosoting and "Cobra" Processes.

A MEETING of the Overhead Lines Association was held at the Institution of Electrical Engineers, London, on February 20th, when Mr. W. Fennell (President) took the chair.

The President announced with sincere regret the death of Mr. A. H. Allen, late Technical Editor of the Electrical Review. Mr. Allen, he pointed out, had been largely instrumental in getting the Association formed, and was its first and only honorary member. At the request of the President those present stood in silence for a few moments.

Two papers, which are referred to below, were then read on timber preservation.

The "Cobra" Process.

By R. H. Herford.

(*Abstract.*)

The object of the "Cobra" method is to introduce strong fungicidal material into the cells of the wood, where it can be caught by the rising moisture drawn from the ground during growth and distributed throughout the timber. The fungicidal material must have strong antiseptic properties, not only to kill any organism that may be present when inoculation and diffusion takes place, but also to guard against future action. The material must also be stable, so that it does not disintegrate or disappear in time, and, further, must so fix itself in the fibre of the wood that it does not leak out. Another important quality demanded is high osmotic pressure, or power of diffusion in water. There is perhaps no substance which contains all these desirable qualities, but there is a simple compound of two substances which contains them in a high degree; the two elements are sodium fluoride and dinitrophenol. The first has high osmotic pressure and diffuses readily, whilst the second has pronounced stability. When mixed with water to the consistency of a thin paste and introduced into timber by means of a hollow needle, the sodium fluoride moves quickly, and soon establishes complete protection: the dinitrophenol follows on and consolidates the position. When required to combat the attack of insects, 20 per cent. of the sodium fluoride is replaced by arsenic.

The inoculation is carried out by what might be described as a large hollow flattened needle, similar to that of a hypodermic syringe. The needle acts first as a narrow wedge, separating the wood fibres, and, secondly, as it is withdrawn, it ejects two jets of preservative into the split originally made. The length of the needle and the consequent depth of penetration of the preservative ranges from 4 to 8 cm. The poles are inoculated along a length of about 3 ft., of which a portion is underground, and the inoculation splits are ranged all round the post in longitudinal, transverse and spiral lines. New poles, when treated, should be freshly felled, or, at least, they should not be fully seasoned, and the bark must be removed before treatment. Standing poles may also be treated, in which case the earth is removed from around the bottom to a depth of 2 ft., or thereabouts, so that the portion of the pole below the ground level may also be treated. A feature of the process is that the preservative will penetrate the heartwood of spruce poles, whereas creosoting will not.

The process is also recommended for inoculating the top portions of poles where the supports for wires are fixed, and also for partly decayed poles. In the latter case, the decayed wood on the surface is removed before inoculation takes place, the whole afterwards being painted with a solution which contains some tar oil. All poles, new or otherwise, are treated in this way after inoculation.

The Creosoting Process.

By Christopher Wade, A.M.I.E.E.

(*Abstract.*)

CREOSOTING under pressure has been used and found satisfactory in this country since 1838, when Mr. John Bethell obtained his original patent for the injection of hot creosote oil or dead oil of tar into the wood to be preserved. Timber so treated is still in use after 30 years, and examples are in existence after 50 years and more, in a perfect state of preservation.

My oldest customers in the North a year or two ago had every pole of some thousands examined and bored into, after being up about 25 years, and found only about 10 doubtful ones; some they took down and re-erected again in other places, as perfectly good for further service. A section of my firm—Messrs. English Bros., of Wisbech—states that the creosoted wooden piling put in the River Nene, at Wisbech, in 1854 to 1856, is perfectly sound now, after 70 years' service. The above facts show quite definitely the value of creosoted timber, and though many processes have been invented and tried in the last hundred years, creosote is the only one which has stood the test of time, and is used almost universally.

The German Ruping process of creosoting now prevails, by means of which the surplus oil is drawn off and the timber is left practically dry to handle. In this process the poles are placed in a cylinder. A vacuum is created, in the first place, to extract any moisture, and then compressed air is applied at a pressure of 60 or 80 lb. per sq. in., which opens up the pores of the wood, and the creosote oil is pumped in on the top of this pressure, up to, say, 150 lb. When this pressure is taken off the compressed air in the cells of the timber expels any surplus oil, leaving in about 5 or 6 lb. per cu. ft.

Whitewood, such as spruce or larch, will not absorb creosote, owing to the pores or grains of the wood being closed up. Larch also has a tendency to split and twist. Penetration cannot be obtained in the heartwood of any wood, even redwood, owing to the cells of the heartwood being sealed up. This fact does not seem to be generally appreciated or understood; but as most decay commences from the outside, this is of little account.

Any preparing, such as arm slots, &c., should be done before creosoting, as otherwise untreated timber may be exposed, so letting in rotting agents, or fungi, which are carried by the wind. The main point of decay is undoubtedly between "wind and water" at ground line, where all the three necessary factors of decay are present—namely, moisture, air and warmth. Some poles have been found hollow owing to the moisture entering at the top and percolating down the poles.

Molesworth's diary gives the following tensile strengths for timber: redwood, 12,000 or 14,000; larch, 8,900 or 10,200; spruce, 10,100; and whitewood, 8,700 or 11,000. I am not quite sure what the alternative figures are for, but in any case redwood is the strongest.

Discussion.

Mr. S. G. Bartholomew (General Post Office) exhibited two samples from poles which had been impregnated on the old Bethell system, one of which had been put into service in 1870, and the other in 1880; both were in splendid condition. The Post Office authorities, he said, had investigated all kinds of processes for impregnating telegraph and telephone poles, other than ordinary creosoting, but they had all been turned down. The later Ruping process had the advantage that poles could be painted after treatment, and that often satisfied local authorities, although he could not say that the painting was altogether satisfactory, after a short time. After the Bethell process creosote always oozed out, and it was impossible to paint afterwards. The Post Office experience with larch poles had not been satisfactory, and Scotch fir poles were best, but it was only possible to get 5 or 6 per cent. of the Post Office requirements of 100,000 poles per annum supplied by Scotch fir. As regarded the Cobra process, time would be the only test, and it would be interesting to know if the process was doing what was claimed for it after a period of years.

Mr. W. A. Turnbull (Aylesbury) said he had always understood that it was impossible to inject creosote into the heart wood, but some of the illustrations shown by Mr. Wade indicated that the creosote had penetrated the heart wood. Did Mr. Wade consider it detrimental to poles to have climbing irons fitted, and would it be necessary to go back to the ladder. Similarly, was it a serious offence from the point of view of the pole to fix "swan necks" for insulators? Again, how far did the creosote penetrate from the ends of the poles, and was it likely to do damage if a 2-in. nail was driven into the end when fixing the top to the pole? What was the cost of a gallon of the liquid used in the Cobra process, and did it require a skilled staff to do the work? He was specially interested in the new method because he could obtain larch poles in his district at 5s. each, and if by the new method it were possible to treat the poles on the spot it would be a great advantage.

The President said the first thing that had struck him was why the Cobra process did not use creosote. He thought that if creosote could be used it would make the process a little less frightening. There was a process called Burnetising, and he had some poles treated by that method which had stood up well. As to the prospects of the Cobra process making home-grown timber available for pole lines, in his district there was the Delaware Forest where there was any amount of timber in all stages which was being grown by the Department of Woods and Forests, and, like Mr. Turnbull, it would be a great convenience to him if some of this could be made available by the use of such a process as the Cobra process.

Mr. Bartholomew said that Burnetising was a process of impregnating with zinc chloride, and a pole so treated could be painted. The process was the alternative to the Bethell process before the Ruping process came in.

Mr. Wade, replying to the discussion, said it did not matter if nails were driven into the tops of creosoted poles for putting the cap on, as the creosote would have penetrated sufficiently for that purpose. It was immaterial whether

the creosote penetrated the heart wood, as that did not decay. He also saw no objection to using climbing irons. If cuts in poles, after the original creosoting had taken place, were painted with a mixture of tar and creosote, it would be found satisfactory. More home-grown timber would be used if it could be obtained; he believed that in the next generation there would be an enormous quantity available. Although he had had no experience of the Cobra process, he felt that creosoting had been so satisfactory that there was no object in changing. The cost of white wood, which, it was suggested, the Cobra process would make available, was not much less than the cost of red wood, and the cost of the process seemed to be quite as much, or even more, than creosoting. He could confirm Mr. Bartholomew's experience with regard to larch, and mentioned that many such poles put up during the war had had to be replaced since.

Mr. HERFORD also replied, and said the trouble with larch was the large splits which occurred; at the Forest Products Research Laboratories, at Princes Risborough, an effort was being made to prevent large splits by making a number of small ones. He did not condemn creosoting, but it had serious limitations. At the same time, it was questionable whether a life of 50 or 60 years was really wanted from a pole, and, therefore, a process which would permit the use of timber not now regarded as suitable, even though its life might be shorter, was worthy of consideration. The records of the Cobra process went back 8 or 10 years on the Continent, and it had been used for from 50,000 to 60,000 new poles and 130,000 standing poles a year in Germany. The Austrian Telegraph Department used the process for treating 20,000 poles a year, and several departments of the Russian Government were also using it. The whole question was bound up with the economics of the supply of poles. On the Continent they had their forests and had to import creosote, and that, of course, made a difference in favour of the process. He quite realised that he had not an easy task in this country against creosote, but he believed, nevertheless, that the process had a field here. The preservative used was in the form of a yellow powder, and cost 2s. 3d. per lb. That quantity was sufficient to treat three standing poles, with a small machine, and, using the large machine, one pole would take 1¼ lb. of preservative.

Electricity Meter Bearings.

A review of the author's experimental and statistical data relative to the leading problem in maintenance, namely, that of worn rotor bearings.

By W. LAWSON. M.I.E.E.

(Extracts from a Paper read before the METER SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.*)*

ATTENTION is drawn to the necessity for improving the reliability of meters in service in consequence of the vast number to be dealt with under modern conditions. The period of sustained accuracy needs to be extended in order to reduce the work of periodically exchanging meters, which is becoming increasingly difficult to contend with. It is submitted that the solution lies in increasing the durability of the bearings, particularly the combination of bottom jewel and pivot which constitutes the footstep bearing. If the rotor had unrestricted freedom of movement it would not make a simple rotary motion, but would tend to move bodily in the direction of drive; when the driving force is applied there is a lateral movement of the rotor which tends to localise the pivots away from the dead centres of the bearings. Observation confirms this, particularly in the bottom bearing, which affords more freedom of movement than does the top bearing, and as the load on the meter increases more side pressure is exerted at the point of the pivot against the curved surface of the jewel, and this in turn produces an upward displacement of the rotor, which, though exceedingly small in the case of a.c. meters, is readily discernible in d.c. meters. The attention of the author was first specially directed to these movements through observing that the worn surface of jewels is not always located

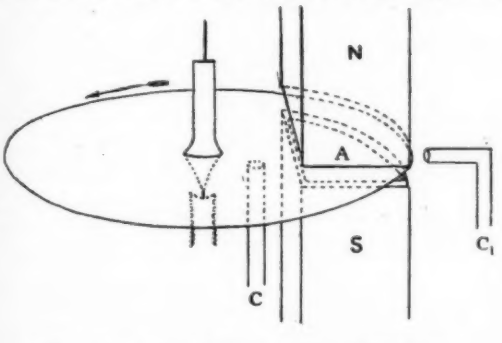


Fig. 1.—Arrangement of Damping Plate.

at the centre of the cup, and they were subsequently usefully employed in devising a means of compensating for the effect of fluid friction in mercury motor meters.

An explanation of the development of the author's ideas in this connection may not be out of place. Fig. 1 shows that the armature, magnet poles and conductors C C_1 conform to the usual arrangement, with the exception that the pole-faces are of sector instead of circular shape, and are so situated as to enable the working flux to embrace as much as possible of the area of the disk near the periphery. The effect of this modification is a considerable increase in speed, due partly to increased torque, but largely to decreased braking consequent on the cutting off of the Foucault currents generated in the disk. In order to reduce speed and so improve the characteristics, a damping plate A consisting of thin amalgamated copper sheet is placed below the armature and parallel to it, in the magnetic field. It has the effect of short-circuiting the e.m.f. generated in the disk and enormously increases the braking effect. It is essential that the under-surface of the armature should be amalgamated. The action that takes place is as follows:—

The eddy currents generated by the rotation, which ordinarily are almost all dissipated in the disk, find a path of low resistance by the proximity of the damping plate. As the speed increases, there is an upward movement of the disk (as

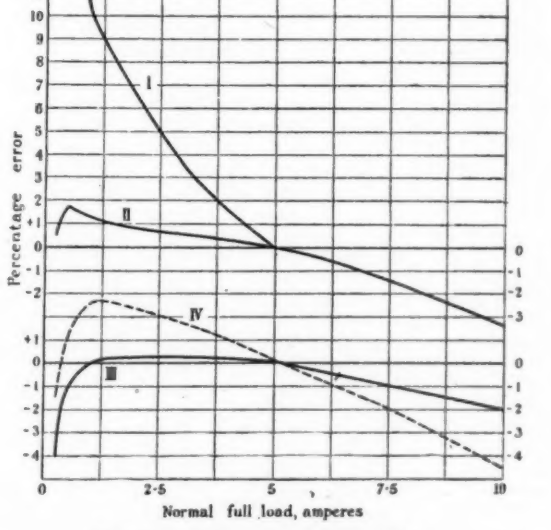


Fig. 2.—Effects of Damping Plate.

already described) which gradually increases the distance between the armature and the damping-plate (the greater the speed the greater the distance between the armature and the plate) obviously introducing more resistance in the path of the eddy currents and thereby reducing the brake torque. Compensation for fluid friction is thereby automatically achieved. No provision is necessary for any more displacement of the armature than takes place in any other meter of this type.

Curve I (full-load speed, 95 r.p.m.), fig. 2, shows the characteristic of a meter without damping plate, curve II (52 r.p.m.) shows the characteristic with a damping plate of medium area, curve III (41 r.p.m.) shows the characteristic with a damping plate of large area, while curve IV (21 r.p.m.) shows the characteristic of a low-speed mercury meter without any form of correction for fluid friction. The damping plate not only helps to compensate for fluid friction, but also tends to

smooth out the hump at the lower loads. The position of the damping plate relative to the magnet pole-face also influences the shape of the curve; fig. 3 demonstrates this.

If the damping plate A, or a portion of it, is made movable, the speed of the meter can be altered at will. The same principle can be applied to the improvement of the overload accuracy of a.c. meters. In this case the position of the brake magnet must be such that the lateral displacement of the rotor reduces the distance between the centre of the rotor and the brake magnet, to reduce the brake torque and so result in speeding-up the meter. To obtain marked results the rotor displacement has to be accentuated by the use of a bottom jewel having a specially wide and shallow cup. Better methods than this are employed to improve the overload characteristics of a.c. meters; it is referred to merely further to illustrate the lateral movement of the rotor.

It is not claimed that a general solution of the bearing problem has been found, or is in sight, and it is recognised that few definite conclusions can be arrived at from the experience and observational and experimental work detailed in the paper. Some advantages may, however, be gained in an endeavour to sum up the situation, and to that end the author formulates his views in the following paragraphs:—

(1) When the cost of a diamond bearing represents a small item of the total cost of the metering equipment, it offers a complete solution of the bearing problem. With low-priced meters its use from a financial point of view is debatable, but might be justified in the long run. Users of meters should seriously consider the adoption of diamond jewels in all meters of, say, 50 kW and over, and manufacturers should assist by placing themselves in a position to supply them.

(2) In a.c. meters vibration contributes to the wearing of the jewel and becomes more destructive with increased working forces in the meter (compare tests of agate pivots in polyphase and single-phase meters). Care should be taken not to overload meters heavily, even if they are designed for accurate performance under such conditions.

(3) Oil-immersion extends the life of the jewel and reduces the effect of wear on the accuracy, but is subject to physical changes and cannot be trusted for sufficiently long periods.

(4) The agate pivot provides a possible means of solving bearing troubles in mercury motor meters which would be subject to very light action and be free from the possibility of damage in transit.

(5) Given bearings of the durability of the diamond, reasonably protected against dust accumulation, with the pivots of all moving parts made of rustless material and no oil being used, there is no reason why the modern a.c. meter period of exchange should not be extended to 10 years, or even longer.

(6) Durability tests of jewels, if carried out, as they should be, under normal working conditions, necessarily extend over long periods of years and consequently do not constitute a sufficiently rapid means of obtaining results. Further, they offer no prospects of determining the root cause of wear upon the discovery of which depends the whole solution of the problem of producing bearings of uniformly high durability from the cheaper stones.

The solution of the problem will come from the scientific research laboratory rather than from the maintenance side, but co-operation of the workers in both fields of inquiry would be a step in the right direction.

The author thanks Mr. R. A. Chattock, city electrical engineer of Birmingham, for permission to carry out the investigations and publish the results.

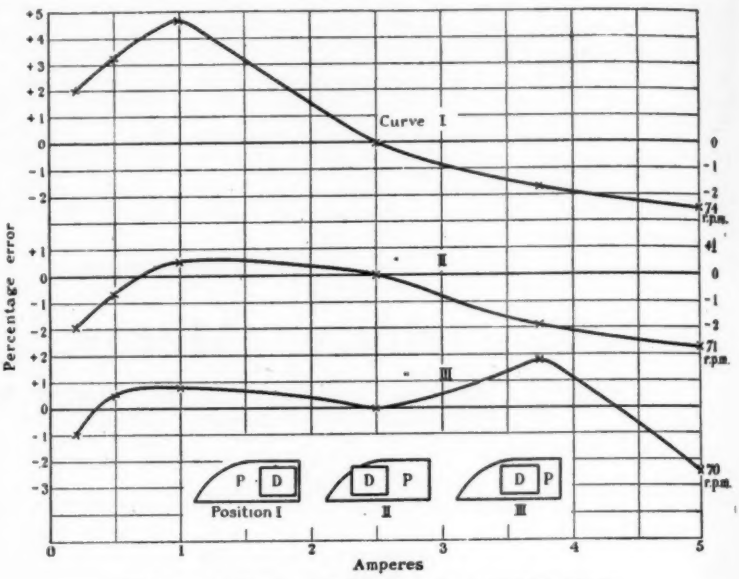


Fig. 3.—Influence of Position of Damping Plate.

Refrigeration on Shipboard.

Some Features of Electrically-driven Compressor Plant.

By H. J. WARD, M.A.

(Extracts from a Paper read before the Institution of Mechanical Engineers.)

Of the various types of modern refrigerating machines, such as carbon dioxide (CO_2), ammonia (NH_3) compression, ammonia absorption, dense air, and water-vapour machines, only the two first named have met with any lasting success on board ship. Analysis of the lists published in the latest issue of Lloyds' Register of Shipping shows that by far the greater proportion of the refrigerating machines installed for cargo purposes operate upon the gas-compression system. Of the total 80 per cent. uses carbon dioxide as the working medium; 18 per cent. uses ammonia, air-compression now accounts for only 0.8 per cent., and other systems for 1.2 per cent.

Within the last few years the use of oil-engines for main propulsion and the increasing practice of driving auxiliaries electrically have led to the adoption of higher compressor speeds. The motors drive through gearing, or directly through a slightly flexible coupling, at speeds up to 150 r.p.m. for compressors with open motion work. As a further step in the direction of economy compressors may be mounted vertically on totally-enclosed frames with the motion parts oiled by forced lubrication; in this case the motor is directly coupled and may run at a speed of 350 r.p.m., or thereabouts. Such machines effect considerable saving of space and attention, and by eliminating gearing almost noiseless running is obtained, a very important consideration when passengers are carried. In a recent example of a vessel driven by oil-engines through twin screws, the CO_2 refrigerating machinery, in two electrically-driven units, affords complete facilities for temperature regulation, according to the distribution of a mixed cargo of fruit, dairy produce, and meat, by means of fan circulation on a new system. Rather too much is sometimes expected of the ship's refrigerating plant, which should not, strictly speaking, be called upon to do much more than maintain temperatures. Quite recently the practice of installing small electrically-driven compressors has been growing. They work with a low-pressure gas, such as methyl chloride, and cool individual cupboards at points too remote from the main plant to be conveniently connected to it. Cooling is effected by direct expansion and automatic starting and stopping of the plant is controlled by a thermostat.

All the larger naval vessels are equipped with electrically-driven refrigerating plant, usually on the CO_2 compression system, and embodying a number of units of moderate size. These are employed for cooling the gun charges, thereby maintaining their ballistic properties, and for the preservation of food for the crew. Certain classes of submarines intended for service in hot waters have been fitted with specially designed and very compact CO_2 machines for the main purpose of keeping the storage batteries at temperatures low enough to retain their capacity and to extend their life, which otherwise is short in the tropics. Advantage is taken of the presence of the plant, as an alternative duty, to cool and dry the air used for ventilation, thereby rendering the con-

ditions more tolerable for the crew. A small cold store is also provided for provisions.

Horizontal machines driven by electric motors through double-helical reduction gear, with a ratio of about 5 to 1, have been used for some large passenger steamers in the Australian trade. Although the intervention of gearing enables the motor to be run at a speed more appropriate to the power transmitted than in cases of the drive being direct, it is impossible to avoid a certain amount of noise from the transmission. With open motion work and gravity lubrication, crankshaft speeds above 150 r.p.m. are generally undesirable for large units. To approach the economical speed of the electric motor while avoiding gearing, totally enclosed motion work becomes necessary, and full speed can be raised to 350 or 400 r.p.m. A type of machine which has been introduced lately for vessels wherein slightly greater headroom can be provided has a pair of single-acting CO_2 compressors mounted on a totally-enclosed frame, with ample doors for access to the glands and motion work, and has forced lubrication to all bearings by means of a pump fitted at the end of the crankshaft. The bearing surfaces are specially liberal so as to allow the use of refrigerator oil for general lubrication as well as for the compressor glands, thereby avoiding the necessity of carrying two classes of oil.

Legal.

Marconi Radio Patent Royalties.

In the Chancery Division, on February 27th, Mr. Justice Luxmoore had before him an appeal by Marconi's Wireless Telegraph Co., Ltd., from a decision of the Comptroller-General of Patents on an application by the Brownie Wireless Co., of Great Britain, Ltd., with regard to the amount of royalties to be paid by the Brownie Co. in respect of licences under patents held by the Marconi Co. There was another case in the list in which the respondents were the Loewe Radio Co., Ltd., but it was stated that the two cases would have to be dealt with separately.

Mr. Whitehead, K.C., for the Marconi Co., said that the appeal raised questions of great importance from the general standpoint of patentees. The Brownie Co. applied for compulsory licences under two patents; the first related to high-frequency reactance and the second to the grid leak invention. The Marconi Co. owned or controlled these two, and about a dozen other radio patents, and had granted over 2,000 licences. These licences had not all been in quite the same form. Five other companies—the British Thomson-Houston Co., Ltd., the Metropolitan Vickers Co., Ltd., the General Electric Co., Ltd., the Western Electric Co., and Radio Communication Co.—in consideration of the fact that they had shared the original risks, were granted licences involving the payment of only 10s. per valveholder, instead of the 12s. 6d. which was charged to other licensees. Also, in the case of licensees whose payments had been upwards of £5,000 or £10,000 there had been a reduction in the rates of royalty. The Marconi Co. offered the Brownie Co. licences on the same terms as the other general licensees, with the exception of the companies mentioned above. This offer was refused by the Brownie Co., who asked for special terms, and, upon being refused these, they asked for a compulsory licence under the provisions of Section 27 of the Patents Act. The Brownie Co. complained that "by reason of the refusal of the patentee to grant licences upon reasonable terms . . . it was in the public interest that a licence should be granted" (by the Comptroller). The Comptroller held that there had been an abuse of the monopoly rights, coming within the terms of the relevant paragraph of the Act. There was also a finding that the applicant was prejudiced by the non-grantmg of the licence. Counsel suggested that a result of the decision would be, if it were upheld, that holders of licences on the regular terms could claim that they wished to change, and if the patentees refused to grant licences on revised and lower terms it would be, on the ground of that finding, an abuse of monopoly rights. The question might arise whether the terms of the licence offered to the Brownie Co. were not, in the circumstances, reasonable. He would further submit that there had been no abuse of the monopoly rights. In the rules of procedure it was stated that all orders of the Comptroller-General under the section in question should be made subject to appeal to the Court. But in the present case there was no order to appeal from. There had been a "decision" which covered various points, but the Comptroller had suggested that the applicant and the patentee should confer and decide on the terms of the proposed licence. He had, in fact, never made an order.

The Judge said he did not see how they could go on in the absence of a formal order.

A conference too place between counsel, and there was an adjournment in order that the Attorney-General might be consulted. Upon the resumption of the case, Sir T. Inskip, K.C., the Attorney-General, said the Comptroller felt that he would have great difficulty in drawing up an order without the assistance of all parties. There were two courses open. One was for the two parties to assume that the decision of the Comptroller was right and that his Lordship had affirmed it, and then on that footing help the Comptroller to make an order in accordance with the decision; or the Comptroller could make an order substituting what he thought were reasonable conditions for those in the licence offered by the Marconi Company, which he thought unreasonable.

The Judge said that the best course would be for the case to stand over so that the Comptroller might call on the parties, if he so desired, to help him with regard to the licence. An order would then be made, and the appeal could be put in the list. He gave liberty to apply, and also gave liberty to the Marconi Company to amend its petition in any manner that might be necessary when the order was made.

Counsel for all the parties interested said they were willing to assist the Comptroller in every way possible so that the matter might be proceeded with.

The case with regard to the Brownie Company accordingly stood over, and the same course was taken with the other case.

Mr. Justice Luxmoore said he hoped it would be possible to get the order drawn up in the next week or so. He would give every facility he could.

An Electricity Supply Dispute.

At the Tavistock County Court on February 21st, Mrs. Alice Ghey, of Crapstone, Yelverton, Devon, sued Mr. C. T. Melhuish, trading as the Crapstone Electricity Supply, for £30 16s. damages for breach of contract, the defendant having cut off the electricity supply to her premises without reasonable notice.

A solicitor for the plaintiff said that when his client complained about failures of the supply, the defendant was rude to her and finally sent an assistant to cut off the supply from outside her house. She denied that she had given instructions for the supply to be discontinued.

The defendant said that in the course of installing a new switchboard at the works it became necessary to disconnect the supply for certain periods. During one period Mrs. Ghey telephoned and said that if the supply could not be restored at once it might be disconnected altogether, and later Mr. Ghey confirmed this.

His Honour Judge Higgins found for the defendant, on legal grounds, and awarded him his costs. A stay of execution was granted.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Electricity Measurement.

As manufacturers of friction compensated d.c. ampere-hour meters, we object to the deprecating remarks contained in the abstract of the paper by Mr. J. L. Carr, read before the Meter Section of the I.E.E. They were obviously based on information given by a competitor and, as such, can have no value (except to prove the reverse). We sell both compensated and non-compensated d.c. ampere-hour meters at the same price, and claim that they are equally reliable.

A.E.G. Electric Co., Ltd.,
H. Horwood.

London, S.W.1., *February 25th*, 1929.

Hydro-electric Power in India.

It has been said that you cannot hurry the East. Mr. G. O. McLean tells us in your issue of March 1st that "It has been estimated that India has available in water-power more than five million h.p., of which only about half is developed at present." That, according to this year's Ready Reckoner, gives India 2,500,000 developed h.p. On looking up my report on the Hydro-electric Survey, I find that in 1922 only 139,000 h.p. of plant was installed, so someone must have been hustling a bit since then; or did Mr. McLean forget to verify his facts?

J. W. Meares.

Guildford, *March 1st*, 1929.

Service and Co-operation.

Your wise remarks on page 364 of your issue dated the 1st instant deserve more than casual reading, and I venture to ask you to again bring the great value of co-operation before your large and influential circle of readers.

May I endorse your remarks regarding the unique opportunities of those who "serve" electricity to co-operate in spreading the good news of electric service, and may I add that those

who receive the benefit of such service, *viz.*, the consumers, may be induced to also co-operate to extend the amount of electricity supply and so add to the common benefit.

You state that the idea is not untried, and, with your permission, I should like to draw attention to the scheme adopted by East Anglian Electricity, Ltd., which was a useful and profitable company. The co-operation was secured by the issue to the employés of "workers'" shares, limited in number, but which carried the right to double the dividend declared on "ordinary" shares, also the shares to consumers which carried a right to a reduction in cost of electricity. Unfortunately the "powers that be," who unfortunately are opposed to electrical development, were able to stop the good work of this company in such directions.

The value of an electric service for power and other purposes is of such importance to the welfare of this country, and especially to rural industries, that any aid towards its advancement is worth noting and adopting.

Napier Prentice.

London, *March 2nd*, 1929.

The Kennedy Memorial.

That there should be a permanent and lasting memorial of affection and esteem for the late Sir Alexander Kennedy is a feeling common to all who knew him or his work.

He was a pioneer in engineering education, for, during his tenure of the Chair of Mechanical and Civil Engineering (1874-1889) at University College, London, he was largely responsible for the lines and methods which higher education in engineering has adopted. As an engineer in practice, his wide knowledge of mechanical and electrical engineering was always available for the service of the country.

In connection with the Centenary Celebrations of University College, a movement was inaugurated to endow the Department over which he long presided with such distinction; and some time ago he had consented to the Chair in the Department being called by his name. Towards the sum of £30,000 required for this endowment, a sum of £18,035 has already been subscribed, leaving the amount of £11,965 still to be raised.

We are in hearty sympathy with this project and feel that no more suitable memorial of Kennedy's great work could be established. We invite all those who knew Kennedy to associate themselves with this memorial. Subscriptions should be sent to the Right Hon. Lord Meston, chairman of the Centenary Fund, at University College, London.

E. Rutherford,
President,
Royal Society.

Brodie Henderson,
President,
Institution of Civil Engineers.

R. W. Allen,
President,
Institution of Mechanical Engineers

K. Edgcumbe,
President,
Institution of Electrical Engineers.

Gregory Foster,
Provost,
University College, London.

University College,
London, *February*, 1929.

Service Boxes.

The correspondence on service boxes should prove interesting and instructive, as so many engineers are inclined to treat low-voltage jointing with a certain amount of contempt, yet most of their mains faults are on their low-voltage networks. Obviously, it should be our aim to restore a paper-insulated, lead-sheathed cable as nearly as possible to its original state; therefore, a pressed-lead service box, or one made up by the jointer out of sheet lead, should be used. If the cores are well insulated with tape boiled in resin oil compound, and the box filled with a high-grade compound, preferably with a resin base, little or no trouble should ever be experienced.

Regarding protection, I prefer an iron box with armour clamps, but many use creosoted wood boxes and tiles. If one waits for plumber-jointers to answer advertisements, one will always experience a shortage of really good men. The obvious remedy is to train them yourself; one way is to get improver plumbers as jointer's mates, and in twelve months an intelligent mate should be satisfactory for low-voltage joints.

Compound will not resist the penetration of moisture indefinitely, and practically every iron box joint made could be topped up next day if the hole could be left open, as shrinkage must occur, and a vacuum is created within the box which will surely suck in moisture in time.

Regarding time taken, I suggest that plumbed work takes no longer, as with iron boxes the jointer should allow two or three hours for cooling and shrinkage of compound, whilst this question is not quite so important with lead boxes, especially if a semi-fluid compound is used when the ratio of pouring temperature to setting temperature is quite low.

To Mr. L. Robbins I would say, let your plumber-jointers always use lead tees, even if those men represent only a small number of all your jointers, as by so doing the number of eventual faults will be reduced.

H. Payn,
Engineer and Manager,
Boston and District Electric Supply Co., Ltd.

Boston, Lincs., *February 25th*, 1929.

Hire-purchase Selling.

In your issue dated the 22nd instant an article on the above subject appeared on pages 326-328, and I would like to make the following comments.

The effect of the interest charge in the example is stated as about 7½ per cent. for the year, but, as the real measure of the accommodation given to the purchaser is of course based on the amounts outstanding from month to month, the interest charge results in a return of nearly 14 per cent. per annum, or, if calculated on the capital involved, assuming this to be the high figure of 75 per cent. of the cost price, 20 per cent. per annum.

E. B.

February 27th, 1929.

Replying to the above letter, I may say that in my article the charges made by finance corporations are given as percentages of the amount advanced. This fact is clearly shown in the example worked out on page 327.

Since the advance and finance charge are paid back in equal monthly instalments, the average balance outstanding over the period is approximately half of the total sum. The rate of interest charged is thus in the neighbourhood of 15 per cent. per annum. This is the actual rate on the amount borrowed, and the size of the initial payment does not of itself affect this figure. The charge can scarcely be considered too high in view of the fact that it covers the preparation of the legal forms, credit investigation, collection of monthly instalments, and insurance.

To base calculations on the actual rate of interest charged would considerably complicate the calculation, because of the effect of compound interest. For this reason the finance corporations almost invariably figure their charge as a percentage of the initial advance.

Ecos.

March 1st, 1929.

Collecting Money from Prepayment Meters.

With reference to the letter in your issue of February 8th regarding the above subject, I have pleasure in giving your correspondent some information on the subject.

We have now connected to our mains over 16,000 prepayment meters, and in the summer time employ five collectors. In the winter months, when the collections are much heavier, that number is increased to eight collectors. These men read the different circuit books alternately, that is to say, no collector reads the same meter twice consecutively. By this method any discrepancy made by one collector will be discovered by the collector who takes the next reading, unless there is collaboration between all the collectors, which is unlikely. We do not find any necessity for two men going together, but occasionally a clerk from the borough treasurer's office accompanies the collector for a day or so from time to time.

With regard to collecting money during the day from collectors with a barrow, or other vehicle, this will depend largely upon local conditions. This town is fairly well self-contained, and all parts are adequately served by the electric car service, and consequently the use of a vehicle to collect monies is not considered necessary. The collectors deliver their collections at noon and 5 p.m. daily to the office, the circuit books being checked with monies delivered by the collectors the following day. The money taken from penny-in-the-slot meters is made up by the collectors in 5s. copper bags; the name of the Department is printed on the bags, and on being handed in at the office, they are stamped with the date and the collector's number. The bags are sent to the bank daily in cardboard boxes, each containing £5 in copper, the boxes being conveyed in a motor vehicle. The collectors commence duty at 9 a.m., are allowed 1½ hours for dinner, and finish at 5.30 p.m.; whilst on duty they are required to wear a uniform provided by the Department.

James Edgar,
Borough Electrical Engineer.

South Shields, *February 25th*, 1929.

I was interested to read in your correspondence columns the letter of "Prepayment," but don't you consider it rather a strange way to stop this systematic fraud to publish these means? It seems to me that you would be acting as an information bureau to awaken the collectors of money from prepayment meters to the system to be used against them, or, in other words, assisting them to ward off detection.

It is a technical job to stop these frauds, and should be left to, or given to, a technical man who knows a meter and

who is paid to know his job. It is the mechanical side of the meter that will stop it; it cannot be stopped by the pen. Consult your meter superintendent.

Regarding the reading of, and collecting of money from, meters, the majority of business houses are well alive by 8 a.m., the same as the villa, and a meter reader should find little difficulty in obtaining admittance at, or about, that time.

Meter Engineer.

February 23rd, 1929.

London Trunk Power Cables.

With reference to the article by Mr. K. Bell, which appeared in your issue of February 8th on the protection of unarmoured cables by slabs of concrete placed above them, it may be of interest to your readers that I happen to know of three cases during the last two or three weeks in which iron bars 1 in. by 1 in. have been put into the ground in search for escaping gas, one of which went right through the concrete covering, and then right through the heart of a 33,000-volt cable; so it would seem that in certain cases even a concrete cover is of no protection, though in cases of excavation by the gas and water companies it should, presumably, save the situation.

"Interested."

March 2nd, 1929.

With reference to the letter which appeared in your columns from "Resident Engineer," has not your correspondent totally overlooked the fact that the discussion is about 66,000-volt single-core cables, and that to put these in triangular formation at a distance apart of 15 inches would be to invite eddy currents of the most alarming nature in the lead sheaths?

A. M. Taylor,
Major, S.O.2.

Birmingham, *March 2nd*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be numbered and abridged, and all subsequent proceedings will be taken.

1927.

20,334. "Alternating-current motors." Maatschappij Tot Vervaardiging Van Snijmachines Volgens Van Berkel's Patent en Van Andere Werktuigen. July 30th, 1926. (275,264.)

20,447. "Electric storage batteries." R. Bosch Akt. Ges. January 11th, 1927. (283,490.)

20,796. "Tuning system for electric circuits carrying high-frequency currents." H. F. Elliott. August 6th, 1927. (305,600.)

21,019. "Manufacture of inductance coils and the like." M. Y. A. Serruys. August 9th, 1927. (305,683.)

22,774. "Means for the production of high-frequency currents." P. R. Coursey and Dubilier Condenser Co. (1925), Ltd. August 30th, 1927. (305,508.)

23,804. "Electrical gasfilled discharge device." F. Meyer and H. J. Spanner. September 9th, 1926. (Addition to 275,552.) (277,364.)

26,678. "Electric protective arrangements." British Thomson-Houston Co., Ltd., S. H. Petch, and F. J. Lane. October 8th, 1927. (Cognate application, 2908/28.) (305,687.)

27,478. "Lampholders for electric lamps." J. B. Taunton. July 25th, 1928. (305,283.)

29,130. "Electric heating devices." Hotpoint Electric Apliance Co., Ltd., and W. J. Sims. November 1st, 1927. (305,500.)

29,236. "Telephone systems." Standard Telephones and Cables, Ltd. (L. Polinkowsky). November 2nd, 1927. (305,691.)

29,372. "Manufacture of electrical condensers and materials therefor." E. W. Jodrey. November 3rd 1927. (Cognate application, 3129/28.) (305,515.)

29,914. "Methods of enamelling, and apparatus therefor." W. E. Beatty (Bell Telephones Laboratories, Inc.) November 8th, 1927. (305,611.)

29,925. "Dynamo-electric machines." J. Stone & Co., Ltd., and A. A. Mead. November 8th, 1927. (305,612.)

29,940. "Sound-reproducing apparatus." C. C. De C. de la Bourdonnais Prince de Mahe. November 8th, 1927. (305,614.)

29,961. "Simultaneous reproduction of sounds and pictures." B. E. G. Mittell and Gramophone Co., Ltd. November 8th, 1927. (305,617.)

29,964. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. O. Passmore. November 8th, 1927. (305,618.)

30,015. "Electric protective systems." A. Reyrolle and B. H. Leeson. November 9th, 1927. (305,696.)

30,084. "Electric inductance coils." J. H. Nichols. November 9th, 1927. (305,702.)

30,089. "Radio and the like high-frequency receiving systems." G. A. Mathieu. November 9th, 1927. (305,703.)

30,174. "Electric protective devices." British Thomson-Houston Co., Ltd., and H. S. Petch. November 10th, 1927. (305,708.)

30,234. "Telephone systems." Associated Telephone and Telegraph Co. November 10th, 1926. (280,576.)

30,273. "Electric geyser or water-heater." A. W. Newland and J. Sabel. November 11th, 1927. (305,713.)

30,510. "Lamps for motor vehicles." British Thomson-Houston Co., Ltd., and C. J. Morton. November 14th, 1927. (305,496.)

30,567. "Apparatus for applying material to cores, particularly applicable to the insulation of cable conductors." W. E. Beatty (Bell Telephone Laboratories, Inc.). November 14th, 1927. (305,688.)

30,793. "Telephonic systems." A. Graham & Co., Ltd., and W. J. Rickets. November 16th, 1927. (Cognate application, 30,794/27.) (305,730.)

30,899. "Telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. November 17th, 1927. (305,731.)

31,067. "Aerial systems for wireless signalling." T. L. Eckersley. November 16th, 1927. (305,733.)

31,350. "Electric secondary batteries or accumulators." H. F. Joel, sen. September 21st, 1928. (305,738.)

32,406. "Automatic switches for telephone exchanges and remote-control systems." H. Baron C. Aldendorff. December 1st, 1927. (305,747.)

32,649. "Loud-speakers." J. Wilson. December 3rd, 1927. (305,748.)

32,733. "Electric thermostats." B. R. Wingfield and B. T. Wingfield. December 5th, 1927. (305,749.)

33,986. "Apparatus for ultra-violet ray treatment." C. A. Cooper. December 9th, 1927. (305,758.)

34,724. "Electrical filters." R. E. H. Carpenter. December 22nd, 1927. (305,771.)

1928.

157. "Locking devices for electric incandescent lamps or the like." General Electric Co., Ltd., and R. J. Kaula. January 3rd, 1928. (305,781.)

1,106. "Apparatus for the production of heat, ultra-violet, and other radiation." L. G. Hawkins & Co., Ltd., and L. G. Hawkins. January 12th, 1928. (305,788.)

1,950. "Means for carrying and holding together a number of galvanic batteries." Oldham & Son, Ltd., and W. F. Wilde. November 10th, 1927. (Divided application on 30,194/27.) (305,724.)

2,319. "Electric heating element." J. Katunsky. January 24th, 1928. (305,799.)

2,770. "Manufacture of electric cables." W. S. Taylor. January 28th, 1928. (305,802.)

4,479. "Radiators heated by steam generated electrically." J. Vigneault. February 13th, 1928. (305,818.)

4,660. "Long-distance cable installations." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks, deceased), Suddeutsche Telefon-Apparate-Kabel-und-Drahtwerke Akt. Ges. February 14th, 1928. (305,822.)

5,645. "Incandescent cathode discharge tubes." C. H. F. Müller Akt. Ges. February 22nd, 1927. (285,843.)

7,155. "Electromagnetically or pneumatically-operated main current switch." C. Bruynis. March 7th, 1928. (305,847.)

7,354. "Talking motion picture apparatus." De Forest Phonofilms, Ltd. May 14th, 1927. (290,564.)

7,391. "Electric heating elements of the immersion type." W. W. Nobbs. March 9th, 1928. (305,849.)

9,633. "Electrodes for electron-discharge devices and the like." Westinghouse Lamps Co. March 30th, 1927. (287,937.)

10,517. "Electrical condensers." Telefunken Ges. für Drahtlose Telegraphie. April 9th, 1927. (288,518.)

10,961. "Insulating caps." Ramie Union. September 23rd, 1927. (297,447.)

11,185. "Method of and means for rectifying alternating currents." P. J. Maffey and J. B. L. Foot. April 16th, 1928. (305,875.)

13,701. "Lighting apparatus." Benjamin Electric, Ltd. May 19th, 1927. (290,667.)

14,789. "Insulation material for electric apparatus." H. D. Symons. May 19th, 1928. (305,887.)

15,477. "Electrode holders, for electric arc-welding." G. Haagen & Cie. May 27th, 1927. (291,114.)

17,717. "Electrolytic apparatus for refining aluminium and for like processes." Soc. Anon. Compagnie de Produits Chimiques et Electro-metallurgiques Alais, Froges, & Camargue. July 4th, 1927. (293,353.)

18,139. "Electric suspension insulators." M. Hentschel and F. Müller (trading as Porzellanfabrik Hentschel & Müller). June 22nd, 1928. (305,895.)

20,011. "Foot-operated controllers for electric motors." W. Fairweather (Singer Manufacturing Co.). July 10th, 1928. (305,903.)

21,368. "Counting apparatus." Telefonaktiebolaget L. M. Ericsson. August 3rd, 1927. (294,983.)

23,077. "Vacuum electric discharge tube devices." Westinghouse Electric and Manufacturing Co. August 13th, 1927. (295,580.)

29,357. "Apparatus for the manufacture of electric insulating tubes." P. Betz. October 11th, 1927. (298,578.)

35,228. "Electric induction furnaces." E. F. Northrup. September 8th, 1927. (Divided application on 301,954.) (305,620.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 27th:—

Edison. No. 493,476. Class 8. Electrical storage batteries (not for medical purposes).—Edison Storage Battery Co., New Jersey, U.S.A. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Indicta. No. 492,718. Class 8. Advertising signs and indicators either electrically illuminated or displayed by means of light reflectors.—J. McCread, 49, Whitechapel, Liverpool.

Electrographophone. No. 498,568. All goods in Class 8.—Columbia Graphophone Co., Ltd., 102-108, Clerkenwell Road, E.C.1.

Celestiona. No. 498,621. Class 8. Radio-telephonic apparatus and parts thereof.—C. French, Celestion Works, London Road, Kingston-on-Thames.

J.O.K. (lettering and design). No. 498,701. Class 8. Electrical accumulators and batteries (not for medical purposes).—J. Toubkin, 33, Long Millgate, Manchester.

Clix. No. 492,400. All goods in Class 13.—Lectro Linx, Ltd., 254, Vauxhall Bridge Road, S.W.1.

Steam Storage.

Dr. E. G. Ritchie, lecturing to the Junior Institution of Engineers recently, said it was a fact seldom appreciated that in the majority of industrial processes the first 20 odd days of the month were entirely absorbed in overtaking the cost of production, and, generally speaking, it was only in the last four or five days that profit was registered. Viewed from that standpoint, increased production was of the utmost importance, since, by crowding into a month the equivalent of one or two additional days, the economic balance sheet might be considerably affected. Every manufacturing process suffered from a "bottle-neck" somewhere or other. Boiler equipment could never meet peak-load conditions without loss of steam pressure, the load factor of the plant would be 50 per cent., and the full capacity of the steam raising sets would only be utilised for an extremely short period of time throughout the working day; but with a combination of boiler equipment and steam accumulator, the time rate of steam demand could adequately be met and all peak loads could be covered with energy which was instantaneously available. In a sugar refinery which he had recently investigated, steam-pressure fluctuations were responsible for reducing the output of the refinery by not less than 15 per cent.; with the installation of an accumulator pressure fluctuations would be entirely eliminated, with a gain in output of the order indicated. Apart from that, the saving in fuel and boiler operating and maintenance costs alone would be sufficient to pay off the capital cost of the accumulator installation in the course of about 18 months.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERGELE (NORTH WALES).—Extension of sanatorium, for Manchester Corporation; city architect, Town Hall, Manchester.

AMERSHAM.—Housing scheme (34), for the R.D.C.; Kemp and How, architects, 4, Bloomsbury Square, London, W.C. (returnable deposit of £5).

BIRMINGHAM.—Students' Union establishment, University (£44,000); J. R. Deacon, builder, Lichfield.

BOURNEMOUTH.—Clinic and school house; borough engineer, Charminster School. Extensions, King's Park Pavilion (£6,000); borough engineer.

BRIGHTON.—Skating rink and restaurant, for Ice Rinks, Ltd.; S. Clough, architect, London. 208 houses, Whitehawk estate, Eadie Towers & Co., Wolverhampton. 36 houses, Crayford Road, 28 in Eastbourne Road, 36 in Hertford Road; Braybons, Ltd. Bathing pool (£175,000); borough engineer.

BURSLEM.—Extensions, pottery works, Nile Street; Doulton and Co.

CAMBRIDGE.—Extensions, Addenbrooke's Hospital (£90,000), for the Governors; clerk. Bazaar premises, Sidney Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

CASTLE DOUGLAS.—New school to accommodate 500 pupils, for Stewartry Education Authority; the clerk.

CHELMSFORD.—Municipal offices, library, &c., Rainsford House site; borough engineer.

CROYDON.—Billiard hall and shops, High Street and Friends Road; North, Robins & Wilsdon.

CULLOMPTON (DEVON).—Residential hotel (£20,000), for a local syndicate; particulars from A. Martin Alford, Exeter.

DEVON.—Schools, Kentisbury, Kingsnympton, and Langtree, for Devon E.C.; county architect, 97, Heavitree Road, Exeter (returnable deposit of £1 1s.).

DOVER.—Extensions, Isolation Hospital (£8,300); J. F. Duthoit.

EARLSDON (COVENTRY).—New St. Barbara's Church (£6,000); incumbent.

EDWINSTOWE (MANSFIELD).—Re-erection (after fire) of the Dukeries Hotel (£10,000); H. Smith, licensee.

FARNHAM ROYAL (BUCKS.).—Four-bay factory, Buckingham Avenue, for Slough Estates, Ltd.

GLASGOW.—Reconstruction, Calton area; city engineer and housing director. 756 houses, King's Park; Western Heritable Investment Co. Extensions at Wood's Hospital; S. Goddard & Sons.

GUILDFORD.—Extension, Nurses' Home, Royal Surrey County Hospital, Bray Road; Governors.

HERNE BAY.—Additions, Mortimer Street; Herne Bay Electricity Co., Ltd. New Council offices; U.D.C. Surveyor.

HIGH WYCOMBE.—Factory, Amersham Hill, for Lord Bros. Factory extensions, for W. F. Baker, Bellfield, and Bartlett & Co., Grafton Street.

HOVE.—Housing scheme (50), for the T.C.; borough surveyor.

HUTHWAITE.—Re-erection (after fire) of factory, electrically equipped, for the Crossley Hosiery Co., Lime Avenue.

IRISH FREE STATE (BALLINROBE, CO. MAYO).—Conversion of Creagh House into County Sanatorium (electric lighting), for the County Board of Health; T. T. Flanagan, County Surveyor, Courthouse, Castlebar.

(DROGHEDA, CO. LOUTH).—Installation of electric lighting in St. Peter's Church and Presbyteries, Presentation Convent, and St. Vincent's Convent; J. P. Tierney and Co., consulting engineers, 44, Kildare Street, Dublin.

(KILKENNY).—Installation of electric lighting at the City Hall; R. C. Murphy, borough surveyor.

KEARSLEY.—Housing scheme (80), Tasker's Lane site; E. Shaw, surveyor to the Council, Council Offices.

KETTERING.—Housing scheme (38), by direct labour; surveyor.

KINGS LYNN.—Extensions, West Norfolk and Lynn Hospital (£20,000), for the governors; secretary.

KNOTTINGLEY.—Housing scheme (48), for the U.D.C.; G. J. Laverick, surveyor.

LINCOLN.—School at Redbourne; Scorer, Gamble & Co., architects, Bank Street.

LITTLEBOROUGH.—Housing scheme (50); surveyor to U.D.C.

LONDON (WOOD GREEN).—Extensions, Trinity School (£13,349); C. Miskin & Sons, Ltd., St. Albans.

(ILFORD, E.).—113 houses, Otley Drive; F. Aldridge, for Suburban Developments (London), Ltd.

(DEPTFORD, S.E.).—Remodelling pumping station (£62,616), for the Metropolitan Water Board; William Moss and Son, Ltd., contractors.

(LEWISHAM, S.E.).—Additions, Lewisham Hospital; Burnard and Pickett, Ltd.

(ALDWYCH, W.C.).—Buildings, vacant site, eastern wing; Bush House, Ltd.

MACCLESFIELD.—Conservative Club, with shops and offices; Burgess & Palmer, architects, Brock Street; Gorton & Wilson, builders, Elizabeth Street.

MAIDSTONE.—Houses (82), London Road, for Cox Bros.

MANCHESTER.—Extensions, Ancoats Hospital (£100,000); secretary.

MATFIELD (KENT).—Re-erection (after fire) of Beech House, residence of J. D. Hay (£3,000).

NAPSBURY.—Extensions, Mental Hospital; J. Laing & Son, Ltd., Mill Hill.

NEWHAVEN.—Development, Saltdean estate, 4,150 houses; Saltdean Estate Co., Ltd.

NORTHAMPTON.—School, St. James' (£29,800), for the Borough E.C.; Pullen & Son, builders, Bridge Street.

PORTSLADE-BY-SEA.—Housing scheme (91), for the U.D.C.; D. V. Howard, surveyor.

PORTSMOUTH.—31 houses, Carcombe Avenue; C. C. Coles.

RAMSBOTTOM.—Re-erection of Royal Picture Palace, for Blakeborough, Ltd. (£6,500).

ROTHERHAM.—Public library; borough surveyor.

SOLIHULL (BIRMINGHAM).—Housing scheme (50), for the R.D.C.; surveyor.

SOUTHBOROUGH.—Central school, Kent Education Committee.

SOUTHEND-ON-SEA.—Sanatorium extensions (£19,000), for the T.C.; borough surveyor.

SWANSCOMBE (KENT).—Re-erection (after fire) of the Cygnet Preserve Works, for John E. Gunn, Manor Farm.

SWANSEA.—Extensions, Technical College; borough architect.

TILBURY.—Maternity and child welfare centre, for the U.D.C.; A. W. Buckner, clerk (returnable deposit of £5).

TORQUAY.—Extensions, Grammar School, Oakhill Road; Governors.

TYNEMOUTH.—Alterations, Hay Hole Lead Works; Messrs. Cooksons.

UXBRIDGE.—Warehouse, Windsor Street; Yiewsley & West Drayton Co-operative Society.

WALTHAM ABBEY.—Drill hall for Essex Territorial Army Association; secretary, Chelmsford.

WELLINGBOROUGH.—Housing scheme (34), for the U.D.C.; surveyor.

WELWYN (HERTS.).—Town hall (£10,000), for the R.D.C.; clerk.

WEST FIFE.—Extension of infectious diseases hospital (£21,000) West Fife Infectious Diseases Joint Hospital Board.

WEYMOUTH.—Maternity, Child Welfare, and Health Department centres (£5,000), for the T.C.; borough surveyor.

WIGAN.—Grammar school extensions (£40,000), for the borough E.C.; Dr. E. Davies, director of education.

WOLVERHAMPTON.—Additional 356 houses, for the T.C.; borough surveyor.

WORCESTER.—Extensions, with maternity home, for the Infirmary Committee; secretary.

WORKINGTON.—Block of business premises and central offices, for the Beehive Co-operative Society; H. Oldfield, architect.

YORK.—132 houses, Tang Hall; S. Higton & Sons, Sheffield. 31 houses, Fifth Avenue; J. Sawdon, Bridlington. Temporary mental hospital; Medical Officer of Health. Warehouse, Fishergate; Rankin Automatic Glass Feeder Co., Ltd. Additions, St. George's Hall, Castlegate; York Cinemas, Ltd. Senior school (360 places), Hewarth, for the City E.C.; director of education.